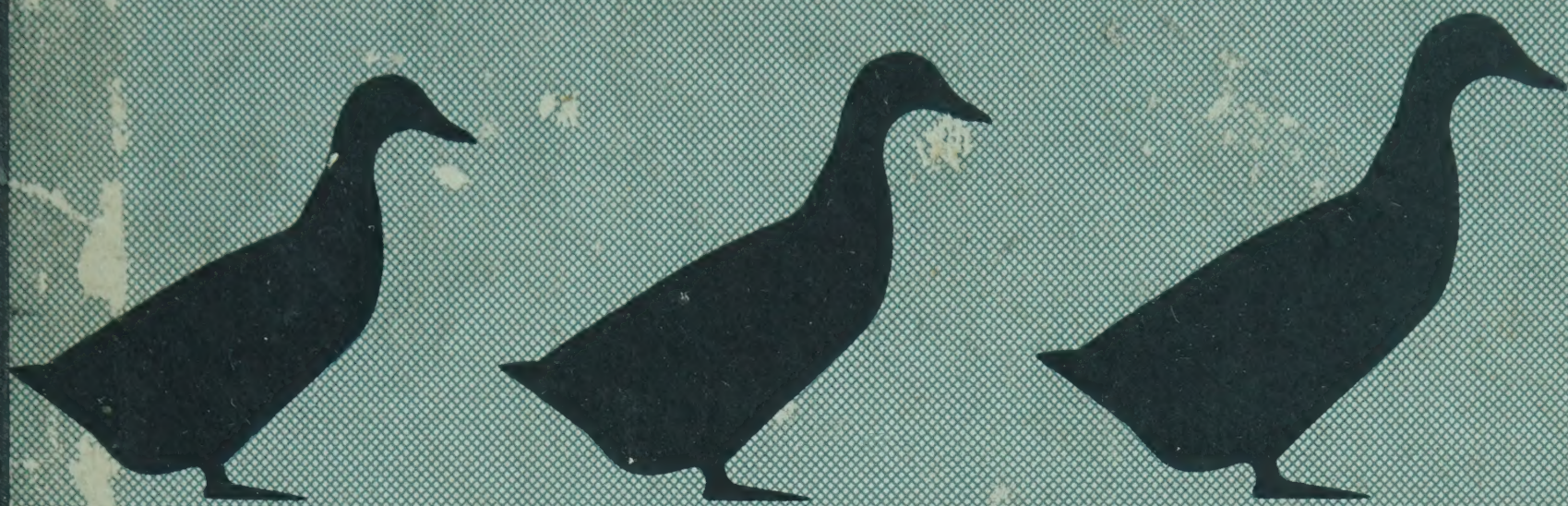




DUCKS AND GEESE

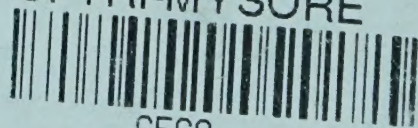


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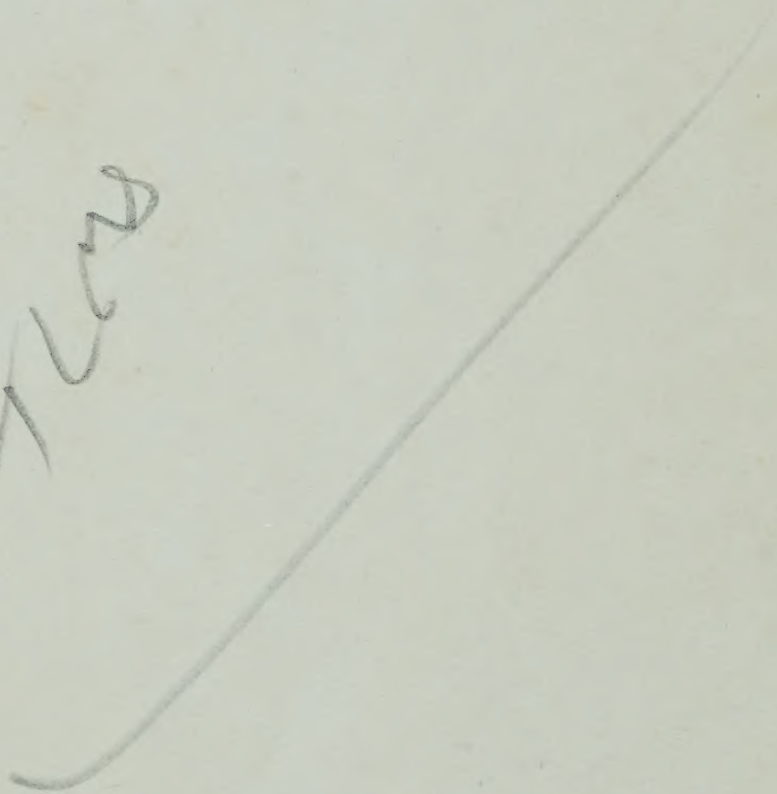


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Ducks and geese

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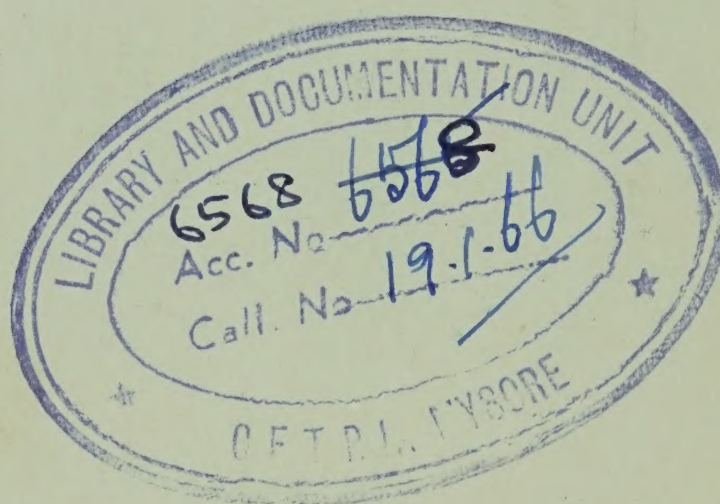
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6568
Ducks and geese...

Foreword

COMING to the fore once again as a tasty and exciting dish, table ducks are now being kept in greater numbers than they have been for several years. There are some signs that the continued decline in our goose population may be slowing down. In no small measure marketing techniques are helping their new-found favour, and provided the birds are managed properly, they can be a profitable enterprise.

It is with the object of presenting the best of modern methods of rearing ducks and geese and establishing sound hygienic systems of management in place of the poor conditions under which the birds are so often found, that this bulletin has been completely rewritten. All aspects of management are covered, and a chapter is included about ornamental waterfowl — one of the few remaining farm enterprises which is both aesthetically pleasing and profitable.

For collaboration in this publication, the Ministry is indebted to Mrs. J. M. Cullington, Mrs. J. Tredgett Wilkins and Mr. L. C. Turnill, all of whom have been able to draw on many years' personal experience, both as advisers and practical duck and geese breeders and rearers.

There seems to have been little scientific inquiry into the breeding and nutrition of ducks and geese, and this no doubt reflects the relatively low commercial importance which has hitherto been accorded to these birds. Readers may, therefore, find this bulletin biased towards the essentially *practical* approach to duck- and geese-keeping. The authors have concentrated upon those methods which have proved successful in practice, but at the same time they admit that more fundamental work may lead to some of their opinions being varied and some of the obvious gaps in our present knowledge being filled.

R. COLES

Chief Poultry Advisory Officer

Ministry of Agriculture, Fisheries and Food
June, 1960

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Introduction

IN ANY CLASSIFICATION of farm livestock ducks and geese are usually placed in the same category. Apart from certain racial similarities, this association may be the result of neither species having enjoyed specialized treatment to any extent, and both sharing equally in periods of popularity and decline. It is not, of course, quite true to say that ducks have never attained the high degree of specialized and large-scale treatment now increasingly applied to fowl, because there are a few very large flocks of ducks in this country, and there is also a highly specialized duck industry in the U.S.A. But generally speaking, ducks and geese are found in very small flocks which are maintained on the farm with the minimum of housing and often with no attempt at balanced feeding.

DECLINE IN POPULARITY

Both ducks and geese have a long history as established members of the farmer's livestock. Both have been subject to a continued decline in numbers in the last few decades. In the middle 1930s the duck population of England and Wales approximated to $2\frac{1}{2}$ million birds; today it is around one million. Over the same period the goose population declined from over 600,000 to a little over 300,000. The reduction in the duck population must largely be attributed to the decline in the popularity of table duck eggs. Unfortunately, there is no quick test to distinguish a carrier of *Salmonella* in ducks, and the few instances of food poisoning traced back to ducks have resulted in a weakening of demand by the general public, following the prominence given to such incidents in the press. Nevertheless, among country people the duck egg is still highly — and rightly — prized for its flavour, and the bird for its high levels of production.

INCREASE IN TABLE DUCKS

The decline in the number of table egg-laying ducks now seems likely to be offset by the increasing numbers of table ducks. The duck is a fast-growing creature, and at $5\frac{1}{2}$ lb live weight achieves a food conversion with a good quality growers mash of rather better than 4:1. At this level it could offer some competition to the rapidly expanding broiler industry on grounds of food cost per lb and speed at which market weights are achieved, although the larger carcass is not in its favour when compared with the smaller broiler and it tends to be rather too fat. Nevertheless, to gourmets both duck and goose will still exercise a powerful attraction, and it is possible that the future will see a continued expansion of duckling production and on a specialist basis.

Geese have an advantage over other species of poultry: their food costs are remarkably low if they are properly managed. They are well known for their grazing habit, although as emphasized in this bulletin, the grass must be moderately good for young goslings. However, in spite of their low feeding costs and the good prices secured for gosling, the number of geese kept is falling off steadily. This may be because of their habits — their proclivity for wandering, their "messiness" and a tendency to be rather destructive.

SCOPE FOR A BRITISH PATÉ INDUSTRY

In this country we have not developed a *paté* industry from goose livers. *Paté* production depends essentially on special feeding and management for large livers, and the handling of the livers in the production of the *paté*. The latter is often a closely-guarded secret, but excellent *patés* have nevertheless been produced in this country. The very cruel overseas methods of stimulating the formation of extremely large livers are not now considered essential, and quite useful livers can be secured with Toulouse strains managed in confinement. This field might prove to be a fruitful one for further investigation among those farmers who have an aptitude for geese rearing and who can establish a market for this highly profitable product.

THE NEED FOR SPECIALIZED FOOD, EQUIPMENT AND HOUSING

Ducks and geese together form less than 2 per cent of our total poultry population. Undoubtedly their relatively small economic significance has relegated them to a low status in the eyes of those who are concerned with development in the poultry industry. For the most part, owners of ducks and geese have had to rely on equipment and housing manufactured for fowl and turkeys. It is rare to find a compound food produced for either species and, in default of special mashes, owners of geese and ducks have had to make do with foods prepared for other kinds of poultry. It must be admitted, too, that the relative unimportance of ducks and geese has not prompted many investigations into their special nutritional needs, and our knowledge of this subject is limited. For the same reason, knowledge of any special requirements during the incubation of duck and goose eggs is not extensive. No doubt, if the downward trend in the numbers of geese and ducks kept were to be substantially reversed, greater attention would be given to these aspects. As it is, rising standards of living and an increasing demand for protein foods which usually accompanies such a rise will probably sustain the small increase in our table duck population. The high rate of egg production from egg-producing strains of ducks is certainly a commendable factor in this age which demands increasingly higher standards of efficiency. It is possible that this consideration may stimulate greater interest in overcoming the handicaps just mentioned in connection with duck egg production. If this were so, the decline of our egg-laying duck population might be checked.

It is against this background — not one unfortunately of a rapidly expanding industry — that the following account of ducks and geese has been prepared. From earlier comments the reader will appreciate that advice on some aspects has had to be based on practical experience only and future research may add considerably to the views expressed or even change them.

ORNAMENTAL WATERFOWL

In these days when hard economics influence the greater part of human effort and aesthetic attractions figure less and less in farming enterprises, it is a pleasure to turn to one aspect of the management of ducks and geese where beauty of form is all important. In the breeding of ornamental waterfowl, all effort is directed towards visual appearance and breed type. The plumage of some of these birds is magnificent and the linking of the word "ornamental" to that of waterfowl is amply justified. Breeding these

birds can be extremely profitable, and there is a strong and increasing demand for them in this country and from overseas. Because of its rising importance, an entire chapter has been devoted to the subject.

DUCKS

Table Varieties

Aylesbury

It seems that white ducks have been known for centuries in many countries, and as white feathered ducks sometimes appear as “sports” from darker-coloured breeds, it is thought that this may have been the origin of the Aylesbury. Its present characteristics have been established by domestication and selective breeding and it was named some time during the early nineteenth century, when large-scale duck breeding was widely carried out in the Vale of Aylesbury in Buckinghamshire. Plumage of both sexes is white, the legs and feet bright orange, the bill of the Utility Aylesbury being yellow and differing in shape from the standard-bred bird whose bill is pinky-white or flesh colour. The standard weight for drakes is 10 lb and for ducks 9 lb.

Although other breeds are now popular it is still regarded as the *de luxe* table bird, since it is light in bone and has a high percentage of creamy-white flesh. Egg production has been improved but it is still by no means high; the egg is white.

Pekin

The Pekin duck originated in China, where breeding had apparently been carried out for many centuries. In 1873 a gentleman from Connecticut, U.S.A., imported these birds from Peking, and they soon gained wide popularity. Since then the breed has served as a basis for table duck production in America, but the modern version is now referred to as the Long Island Duck. There is no positive evidence to show whether they came to England via America or direct from China. The Pekin tends to be smaller than the Aylesbury, and it is a better layer and more fertile. Plumage is creamy-white, the flesh yellow, and bill and legs deep orange. Although it is well fleshed and matures quite quickly it is not considered to be nearly as good as the Aylesbury so it is often crossed with it. Drakes weigh 9 lb, ducks around 8 lb and the eggs are white.

Muscovy

The Muscovy or Brazilian duck is popular in Australia, where valuable work has been done to improve its table qualities. It is known to have existed in South America round about the sixteenth century and there is still some degree of doubt expressed as to whether it should be classed as a duck or a goose. It grazes like a goose and furthermore has no curled feathers in the tail, which distinguishes the sex in other drakes. Incubation period is 34–36 days as opposed to 28 days in other breeds. There are no feathers on the face, but the skin is bright red, whilst the drake has a knob on the head which gives the appearance of a crest. Neither sex has a voice, and

their sole means of communication is a sibilant hiss. If a Muscovy is mated to another breed, the progeny are sterile.

There are seven varieties: white-winged black—the most popular; white-winged blue, black, white, black-and-white, blue-and-white, pure white. The bill is yellow and black with some red, shading lighter towards the tip. The legs are yellow rather than orange.

The ducklings usually take not less than 16 weeks to mature; in many instances much longer. The flesh is dark and has rather a “gamey” flavour. A distinctive feature of this breed is that the male is about twice the size of the female, drakes weighing 10–14 lb, ducks 7–8 lb. The eggs are white.

Rouen

As its name suggests, the Rouen is of French origin, and it is noted for its beautiful appearance. It resembles the Mallard or wild duck more than any other breed and it seems to have been imported into this country many years ago. The plumage of both sexes is exceptionally vivid, the bill is a greenish yellow, legs and feet brick-red. The drake weighs about 10 lb, the duck 9 lb.

It is claimed that the Rouen has the most distinctive flavour of all breeds. It takes a long time to mature and is not ready for killing before 20 weeks, which makes it uneconomic to keep. Apart from this it is difficult to breed true to type owing to its varied colouring. It lays a green egg.

White Campbell

Details of this duck are given in the chapter on Egg-Laying Varieties, p. 11.

White Table Duck

The White Table Duck was introduced by W. W. Cook of Norfolk in 1952. It is bigger than the Pennine but not as large as the Aylesbury, and it was bred by crossing exhibition and utility Aylesbury with the utility Pekin, the object being to produce a duck that would weigh 5–5½ lb at 8–9 weeks. On an average, the drake weighs 9 lb and the duck 8 lb. The plumage is pure white and the bill flesh-coloured, the legs and feet deep orange. It lays a white egg.

Orpington

Details of this breed are given in the chapter on Egg-Laying Varieties, p. 13.

Pennine

Will Bradley of Lancashire introduced the Pennine about 1931, his object being to produce a duck within the weight range of 5–6 lb at 9 weeks. It should be of good carcass quality and capable of producing eggs all the year round. He used Aylesbury, Pekin, White Campbell and Fawn Runner blood, besides importing some Long Island Ducks from America and mating them to these crosses.

The plumage is white, the bill pink, the feet orange, and they lay green or white eggs.

Neither the White Table Duck nor the Pennine is recorded in the Poultry Club Standards.

BREEDING METHODS

The amount of pedigree work done in this country on duck breeding has been exceedingly small, and improvements that have taken place in breeding flocks have been due to selection by handling. This has meant that body conformation and weight has greatly improved but other economic factors, such as egg production, hatchability and growth rate, have advanced only slowly.

The general practice on most farms seems to be to flock mate for fattening and to use smaller pens for replacement purposes. Little information of value can be collected from this system and progress, if any, must necessarily be slow. Individual pen mating for potential breeders would be an improvement and a restricted programme such as this gives some useful details, such as fertility, hatchability and egg production, whilst the progeny can be toe-punched to the pen and sire. Females from the most satisfactory pens can be used for future breeding and males from the best pens for distribution through the flock.

The aim of all producers should be to increase the number of quality ducklings per breeding duck, and, to achieve it, recording of some kind is necessary. The average breeding duck in this country probably produces 50–60 ducklings per year. In Long Island, U.S.A., at least a hundred are expected, and anything less than this is not considered satisfactory.

The whole basis of upgrading must essentially be the mating of superior individuals from superior families. Some knowledge of genetics is needed to carry out a programme of this kind, but it need not be profound provided that the wider principles of the subject are known and understood. To improve the standard within a reasonable and economic time calls for some definite breeding policy, and the rate of improvement will naturally be dependent on what policy is pursued and how detailed it is.

The duck breeder is quite favourably placed, as some of the factors with which he is concerned have a relatively high rate of heritability.

PROGENY TESTING

Unfortunately, progeny testing is expensive and it will only be worth pursuing and at the same time give a financial return, if it is done on a fairly large scale. The stock selected for breeding should be divided into pens of 1 drake to 5–6 ducks. The females are trap nested and the progeny wingbanded to sire and dam. This means that families have been established. From the information made available, the best families can then be selected for characters, such as egg production, egg size, hatchability and body conformation. From these details, say half of the best families can then be identified. Assuming that each breeding duck produces 10 suitable female progeny, and if the breeding birds number 150, this means that 750 ducks are available for selection. From the best of these will be chosen the future breeding stock, in this case, 150 females. The drakes are then selected from the most superior pen or pens.

HAGEDOORN SYSTEM

The Hagedoorn System was introduced by the Dutch geneticist whose name it bears. It is useful when pedigreeing cannot be carried out as valuable information can be collected from the pen as a whole. The system specifies

that to obtain satisfactory results not less than five males should be used. The progeny are recorded to the pens, and not to the individual, which of course means that there is no trap nesting. On the records available the superior pens are identified and they contribute the males and the females for the next breeding season. Progress is of course slower than by progeny testing.

FOUR-PEN SYSTEM

Upgrading of the flock would also be achieved by using the four-pen system provided the stock is good and above average quality. It must be realized that any form of inbreeding tends to reduce genetic variation, and if the flock is not of a high standard at the commencement, no advantage will be gained. The birds can be quite unrelated at the start. After each year's breeding the ducks remain in their own pens and only the drakes move around. For example, for the second breeding season the drake hatched from pen 2 the previous year goes to pen 1, from pen 3 to pen 2, etc., and eventually the order is reversed. This means that throughout the pens the genes of both males and females are re-assorted.

INBREEDING

Good results can be obtained by inbreeding if the flock is of a relatively high standard. The system seems to frighten many people, but there are degrees of inbreeding, and by crossing not very near relatives bad factors will not come to the surface as quickly as from, for example, a father-daughter relationship.

By adopting this breeding method, the variations between birds of similar breeding will become less and less obvious, and it will lead eventually to greater uniformity. New blood should only be introduced if it is necessary to add a specific factor, and if this is done, the introduction should be tested before using it in the main flock.

Haphazard breeding will lead nowhere and those farmers who have no definite breeding policy would be well advised to select their females by handling and then to purchase drakes from a reliable breeder, pedigree if possible. In an attempt to achieve some sort of uniformity they should return to the same breeder for stock each year.

SELECTION OF BREEDING STOCK

1. WHEN RECORDS ARE NOT AVAILABLE

The aim of the breeder of table ducks should be to select stock which conforms to what is desired in the marketed product. The points to be considered are:

Body Conformation:

Depth: This can be assessed by the depth from the back to the point of the keel.

Width: This is judged by the shape or curve of the ribs and width of the keel. The latter should be the same width throughout with no tendency to taper. Neither a very long nor a very short keel is desirable.

Birds not conforming to the desired weight should be discarded, since this factor is inherited and a small-bodied bird will have progeny of small body-size. All potential breeding stock should be weighed at nine weeks

when the weight should be recorded and kept for reference purposes at the final selection and at the same time ducks showing any deformity or lack of fleshing qualities should be discarded. At this stage the birds should be vigorous, healthy, not too fat, but in good condition and capable of moving freely.

Body conformation of the drakes is equally important; again depth, width and breast length are factors to be considered and their weight should be in proportion to the size of the females. As with ducks, they should be hardy, healthy, active and have a good carriage.

Flesh colour:

Selection for this character is important as the market preference is for white flesh; any tendency towards a yellowish tinge should therefore be avoided. Yellow or orange billed birds sometimes appear and are best discarded as these can be an indication that the flesh is also yellow in colour.

Health:

Only stock with a known good health record should be retained for breeding. Ducklings that have survived any of the Salmonella infections should under no circumstances be used.

Breed Type:

Provided that other factors of economic value are considered satisfactory, adherence to breed type should be taken into account.

SELECTION OF BREEDING STOCK

2. WITH AID OF RECORDS

Handling of the potential breeders should be carried out before the records are referred to and stock should come up to the required standard for body conformation first. Then the records can be examined. Under progeny testing it will be possible to identify each bird and to assess its relationship to the rest of the flock. Better results will be achieved if selection is on a family basis choosing superior individuals from superior families. If pen mating has been the breeding policy superior pens are selected, since there is no history of individual birds. The factors to be considered are egg production, fertility, hatchability, growth rates, and food conversion if it is recorded.

At first any breeding policy will show a wide variation in results, and careful selection for these economic factors should be considered collectively with no concentration on any particular one at the expense of the others. Average all-round improvement should be aimed at since little would be gained by improving hatchability if egg production were well below average.

Age of Breeding Stock

Only fully matured birds should be used for breeding, and on average the ducks should be not less than seven months old and the drakes eight months old. About 30 per cent more should be hatched than will actually be needed for breeding to ensure an adequate selection. It is undoubtedly more economical to use first-year birds who will usually eat less food, lay more eggs and be more fertile; in other words they will produce more progeny. Retention of older stock is justified only if there is a particular

reason, and after the hatching season the flock should be handled to make certain that the only birds retained are those still in lay and in good condition.

MANAGEMENT

Warm, dry housing and artificial light are now being used to obtain eggs throughout the year. There is demand in the trade for all-the-year-round production, which means having two, or sometimes three breeding flocks. Even so, it is not easy to maintain a constant supply of hatching eggs. Egg production, fertility, hatchability and growth rate will vary according to the time of the year, and to keep these at a reasonably satisfactory level requires considerable skill. Ducks hatched in March and April will come into lay during August to September, and with careful management and the aid of artificial light, they should continue through the winter. All-night lighting is preferred as sudden switching on may upset the flock, but if the day length is to be extended the lights should go up in the morning ensuring a 14-hour day. A 60-watt bulb to start with, reduced to 40-watt after 2 hours, by using a time switch, will give the required amount of light for 200 sq. ft floor space. The second flock hatched in October to November need no special housing or management and should lay in the early spring and continue until July or August. Some breeders use three flocks, each one being put out-of-lay as soon as egg production drops below 40 per cent. It is considered uneconomic to continue production below this level since reduced fertility and hatchability seem to accompany a reduction in output. These birds are then moulted and brought into production again for the second time.

The drakes should be put into the breeding pen at least a month before production commences, thus giving both sexes time to settle down prior to the collection of hatching eggs. For flock mating, four to six ducks per drake are usually allowed, but the precise number will depend on the breed and age of the stock. Drakes do not usually fight, but to prevent any likelihood of this happening they should be reared together.

Fertility is often upset by what is termed the "favourite duck". For some reason the drakes take a fancy to just one or two and they spend their time chasing and fighting over them. These favourites should be removed to restore peace to the pen.

It is claimed that breeders give better results if they have access to running water; they certainly appreciate it and if it is available it will do them no harm, except perhaps during severe weather when fertility may be affected.

NESTS

Unless trap nesting is carried out ducks do not usually need nests, and in any case they may be disinclined to use them, as they prefer to lay on the floor. Some farmers do provide laying accommodation by placing shallow boxes at ground level around the walls of the house.

Nests fitted with trap fronts are also placed at ground level and the ducks should gradually be trained to use them although this may take some time. It can be a tedious job as at first each duck has to be put into the trap nest, but they will gradually get used to this procedure, and as they are driven into the house at night they will soon enter the traps unaided. The usual measurements for a nest is $12 \times 18 \times 24$ in., and it should be sufficiently large for the duck to settle in comfortably.

ARTIFICIAL INSEMINATION

There has been a certain amount of experimental work on artificial insemination but as far as is known it has not yet been done on a commercial basis.

HOUSING

It is usual to allow $2\frac{1}{2}$ –3 sq. ft floor space per bird and approximately 100 ducks to the acre where runs are not used. If runs are used it is normal to give each breeding duck approximately 25 sq. yd.

For winter egg production good housing is a necessity. Converted farm buildings are being used successfully, and if they are available they will substantially reduce housing costs. If the house is reasonably warm the eggs and water will not freeze so readily, but it need not be elaborate in any way. The ducks will only use it at night, and unlike chickens they prefer to spend their time in the runs. A solid floor is more suitable than slats and a concrete one preferable to wood, but a house built with an earth floor will be quite satisfactory whilst the cost will be substantially lower. It will be necessary, however, to place wire netting at least 12 in. below ground level to keep out rats. It is not advisable to have floor lights, and windows should be placed as high as possible to prevent the birds being frightened by passing traffic. Too much light is not recommended; some houses have no windows but are ventilated by means of shutters. Plenty of air is needed as ducks dislike a warm, stuffy atmosphere. Peat moss or straw can be used for litter; the latter is probably the most suitable but it should be dry and frequently renewed. If damp straw is used it is possible for mould growths from it to penetrate the shell of the egg and adversely affect hatchability. (See p. 16.)

BROODINESS

Ducks are not so prone to broodiness as chickens and if they are kept away from comfortable sitting places they will soon get over it. They can become quite vicious, and if they are handled they will hiss and raise their feathers in protest.

MOULTING

Ducks will moult in accordance with their hatching date. For instance, spring-reared birds will probably do so during the early part of the following year, whilst those produced in the autumn, during July and August. On the other hand, it can be brought about at any time by any sudden change or fright.

Where all-year-round hatching is practised, moulting can be forced in the following way to keep up a steady flow of eggs:

- Cease artificial lighting;
- Move the birds to a different environment;
- Walk them some distance to their new pens, if this is practical;
- Restrict the diet to 2 oz grain per bird per day.

Such measures will soon assist the ducks in dropping their feathers and resumption of normal feeding will depend on when the eggs are required. As a general guide "steaming up" with a breeder's diet should start about a month before the eggs are to be set, and this can be accelerated by the use of artificial light during the winter months.

FEEDING

Most duck breeders use the same ration as that compounded for breeding hens, and it seems to give satisfactory results. If grain is given the amount should be relative to the protein content of the mixture. This question of grain feeding is important, for if it is done indiscriminately, not only will egg production be affected but there may be insufficient of the essential vitamins including those concerned with hatchability. Continuous or intermittent feeding are both satisfactory, and choice will depend on personal preference and availability of labour. Pellets fed *ad lib.* have become popular during recent years as they give much less work than wet mash feeding, but some breeders still maintain that two meals of wet mash a day, one given in the morning and one in the afternoon is the most satisfactory system for breeding birds.

Food consumption will vary according to range available, breed, quality of diet, rate of production. As a guide to consumption, a bird will eat $6\frac{1}{2}$ –8 oz per day of a properly balanced diet. An ample supply of clean water should be available to the birds at all times.

RATIONS FOR BREEDING DUCKS

The following ration is suitable for feeding to breeding ducks:

	<i>cwt</i>	<i>lb</i>
Coarsely-ground wheat	3	
Fine-ground oats	2	
Fine-ground barley	$2\frac{3}{4}$	
Dried grass	$\frac{1}{2}$	
White fish meal	$\frac{3}{4}$	
Extracted decorticated ground-nut meal	$\frac{1}{2}$	
Dried skimmed milk	$\frac{1}{2}$	
*Limestone Flour		12
*Manganized salt		$3\frac{1}{2}$

* Or minerals according to the maker's recommendation plus Vitamins A and D to supply the following per half ton.

Vitamin A	1,500,000 I.U.
Vitamin B ₂	3,400 mg.
Vitamin D	200,000 I.U.

A supply of calcium grit should always be available in the form of oyster shell, limestone or cockleshell plus flint grit.

Manganized salt is prepared by mixing 4 oz manganese sulphate with 10 lb salt.

One oz grain per bird per day should also be provided; ducks seem to prefer this placed in shallow water pans which is less wasteful than throwing it on to the ground.

Egg-Laying Varieties

For all practical purposes the only high egg-producing breed today is the Campbell.

Campbell

The *Campbell* was originated by Mrs. Campbell and introduced in 1901. It was the result of crossings of Fawn and White Runner, Mallard and Rouen, and was intended for use solely as a high egg-producing breed.

Plumage of the original duck was the colour of withered grass while the drake followed the colouring of the Mallard male, but was rather lighter and had no white collar.

Although not originally intended for the show bench, the Campbell is today one of our most popular exhibition breeds and standards laid down for it have resulted in a more uniform colouring. The *Khaki Campbell* is the variety of Campbell resulting directly from colour selection of the original Campbell. The Khaki female is a warm khaki throughout with head, neck and wings a slightly darker shade of khaki. The rest of the body has each feathering narrowly laced with a slightly lighter shade of khaki which on close examination is seen to form a pattern of lacing. The drake's plumage on head, neck, stern and wing-bar is a lustrous green-bronze, the remainder an even shade of warm khaki.

The legs and feet of the original duck were an orange-brown, but today, the Khaki's legs and feet should be as near body colour as possible. Legs and feet of the drake are orange.

The *White Campbell* arrived as a sport from the khaki and, later, the *Dark Campbell* was bred by Mr. H. R. S. Humphrey from cross-matings of Khaki Campbell female with Pekin male to result in a variety which sex-links with pure Khaki females. In spite of its sex-linked characteristics and resultant usefulness, the Dark Campbell has never achieved much popularity. Probably this is because day-old ducklings are much more easy to sex by the vent method than day-old chicks.

The White Campbell has never been as popular as the Khaki Campbell for egg production only, although females have been crossed extensively with heavier males such as the Pekin and Aylesbury for use as a lighter-type table duckling to incorporate the higher egg production of the Campbell with increased weight and table quality of the heavier breeds. Unfortunately, the resulting progeny are often misleadingly styled "Aylesbury".

Colouring. The Dark Campbell is very much lighter than that of the Khaki; and whereas the latter is a warm khaki, the Dark variety is a very light brown, very finely pencilled with grey-brown, the head, neck, stern and wing-bar being beetle green. The Dark duck is very much darker than the Khaki duck in general appearance; where lacing is seen in the Khaki the Dark duck has pencilling, and the colouring is reversed, the pencilling being of a much darker shade of brown on ground colouring of light brown. Apart from the rump, which is beetle green, the remainder is a dark brown. The drake's legs and feet are bright orange, the duck's as near body colouring as possible.

The plumage of the White variety is pure white throughout with bill and legs bright orange.

Standard weights for all varieties are drake 5-5½ lb, ducks in laying condition 4½ lb-5 lb.

Characteristics. The type required for show purposes and the standard laid down for the breed conform to the requirements for a good highly productive strain. Carriage should be slightly upright, at an angle of approximately 45 degrees; it should not be so low as to cause waddling nor too upright, like the Pekin or Runner. The breed should look alert and very much alive.

The body should be deep, wide and compact, of about the same depth throughout from shoulders to breast and from back to thighs. The breast should be rounded and well developed allowing plenty of lung space, and wings should be carried close and high. A good type of bird looks compressed, hard and "tough". The head should be refined with high-set eyes which look bold and bright. The bird with a sagging abdomen instead of one which is rounded in a gentle upward curve from breast to tail will probably have poor fertility and should be avoided. This applies to all duck breeds of similar carriage to the Campbell. Males of such type and those which are too near the horizontal appear to lack vitality. When picking out future breeders it has been noticed that those that run rather than waddle, and those that "display" are most likely to produce the best stock.

Because of its popularity more breeders have taken up the breed and as a result of competition amongst breeders and greater selective breeding, fantastic egg records have been achieved with the Khaki. Individual records of almost an egg a day in twelve months laying from the date of the first egg have been known, and flock averages well over 300 eggs per annum have been obtained. Standards lay down that the egg of the Khaki shall be a pure white.

Fawn Indian Runner

The Fawn Indian Runner was introduced into this country from Malaya. The *Fawn* and *White* variety was standardized by the Indian Runner Duck Club in 1907, the *Fawn* variety in 1913 and *Black and Chocolate* varieties in 1916. Today the Fawn variety and the White variety are the most generally exhibited and classes for them are well supported. Blacks and Chocolates make an occasional appearance. The Fawn and White variety is very rarely shown, in spite of the fact that at one time it was by far the most popular variety.

Although the breed is not used for egg production on a commercial scale in this country today, before the Campbell made its appearance the Runner was considered the laying breed *par excellence* of the duck world. Individual egg records were high, and really good average production was possible from good strains. Small flocks are still kept to meet domestic requirements.

Eggs of this breed vary in colour from white to deep green and are of good size and quality. Although now bred for show rather than with any intention of increased egg production, it would be well worthwhile developing a high-producing strain, as a good number of eggs can be obtained with low food consumption.

Characteristics. The outstanding feature of the Indian Runner is its unmistakable type and carriage. Unlike other breeds to be seen today, the

Runner has not got pronounced shoulders and there is no great depth of body, so that the whole appears as a very gentle and gradual expansion of the neck when viewed from the front. From the side, although the back line is merely an extension of the line running down the back of the neck, the front line is a continuation of the neck running in a very gentle curve to the tail. If an almost perpendicular carriage is also visualized which gives a lean, racy appearance, with wings small in proportion to the size of the body and carried well packed into the body and crossing over the rump, one has a rough picture of the general outline of the breed. The head should be lean and racy with the line from tip of bill to back of head perfectly straight, and the lower line of the bill running in a straight line with the jaw, so that the whole forms an elongated wedge. Eyes which should be prominent, bright and intelligent, are placed so high in the skull that they appear to be part of the top line of the head.

When excited the Runner often stands perfectly upright, a side view appearing as a straight line from the head, down through the neck and body to the feet, with the tail sometimes tucked right back under the body and between the legs. Sometimes the stance is such that the body goes past the perpendicular, the tail going even further to the front between the legs and the bird almost overbalancing.

The length of a drake should be 26–32 in. and a duck 24–28 in. to conform to Club standards.

The above is a description of the popular type and typical Runner of today, but even from well-bred strains, and noticeably in the Fawn and White variety, some of the birds are coarser in type, show more shoulder and are shorter than the measurements given. So long as a “weedy” type is not bred and the breeder aims at producing a racy, “dynamic” type, the standard laid down should be conducive to greater activity and foraging powers.

Buff Orpington

The *Buff Orpington*, another breed which was at one time quite popular, was originated by William Cook from matings of Indian Runner, Rouen, Cayuga and Aylesbury. Unfortunately the breed is now in the hands of only a few breeders. The Buff was intended as a triple-purpose breed to have good egg production together with good table qualities and beauty of form. No one of these points were to be bred for at the expense of the others.

Probably because the trend has been towards the Campbell when a laying breed was required, the Buff has not been bred to the same standard for egg production, and the average production falls short of that obtained by the Khaki Campbell. The Buff lays a really good white egg with green eggs cropping up in some strains. These are usually of exceptionally good shape. As regards table qualities, the Buff does not come up to either the Aylesbury or Pekin for size. Quality of carcass is also inferior, but here again this is probably due to lack of breeding rather than to the breed, and the fact that as a coloured breed it is not so suited for table purposes.

As a result of trap-nesting this breed, there have been individual records of over 260 eggs and when this recording ceased average production was in the region of 240.

For anyone intending to keep a few ducks to meet their own domestic

needs in eggs and an occasional table duckling, at the same time having a decorative bird, the Buff seem to fill the bill.

It is rather similar to the Campbell in carriage but in type the breed is altogether larger than a good Khaki, and the abdomen of the duck when in lay almost touches the ground.

Both sexes are an attractive deep reddish-buff, but whereas the duck is buff all over, the drake has a seal-brown head with this colouring finishing in a sharply-defined line around the neck. The rump is red-brown. The bill of both sexes is orange, legs a bright orange-red.

When crossed with Aylesbury males hatchability rates are exceptionally high, with a very definite improvement in size and carcass quality over the pure Buff. Progeny are, however, mostly coloured.

Other varieties of the Orpington are the *Black and Blue*, which have never gained the popularity that the Buff once commanded. *White Orpingtons* have appeared as a sport of the Buff and such birds should be really useful if fixed for crossing with table birds.

Other breeds which have appeared from time to time are hardly worth consideration as layers because of the smaller number of eggs laid.

BREEDING METHODS

Breeding methods for laying ducks vary considerably, but before describing any of these, two points are stressed:

with every breeding season a higher standard of selection should be aimed at, selection along the right lines is the key to improvement, and is essential in any breeding system.

The prospective breeder should have a very clear idea of what his ultimate aim is before he starts. In breeding, good results are never obtained by chopping and changing, even though it will sometimes be necessary to alter methods slightly. Each mating should be thought out carefully with a definite object in view.

If selling stock, the breeder's aim should be to breed stock most likely to fulfil all customers' requirements. For instance, the requirement of a laying breed is not high egg production only; there is also an overseas demand for a strain that combines this characteristic with good breed type and colouring.

The breeder's job is to collect desirable characteristics and eliminate undesirable ones, making a strain that is "fixed" for desired factors. Whichever method of breeding is adopted, the rule should be not to breed from a bird that possesses any defect, unless it has a high potential for a desired factor which it may be impossible to find in another bird in one's own stock. Such a bird should not be mated to an opposite which carries the same defect. If a bird excels in one point but is lacking in another it should be mated to an opposite with the characteristic it lacks; in other words the aim is to even up the stock by combining outstanding points. By mating together two defectives or by breeding from a defective bird twice in the same line one gets a double dose of the defect and the more concentrated the defect becomes the harder it is to breed out. The same thing applies to desired characteristics — the more often they are bred into a strain the more fixed they become.

LAYING BREED REQUIREMENTS

There are four requirements of a laying breed:

High egg production;

Fertility and hatchability — at least of a standard sufficiently high that the stock is economical to replace;

Type — i.e., body conformation (fertility depends to a large extent on this)

Colour — if the aim is also uniformity of colour.

It goes without saying that the more factors desired in the stock the greater the number of permutations that arise in achieving them, and the longer it will take to reach the final objective. Having achieved it, the aim must be to retain it as a whole, which means continued selection and a higher standard if there is to be further improvement.

It has often been said that breeding for shows spoils the utility quality of a breed, but where the show standard is not in opposition to the requirements for a good layer it is not clear why this should be so. Club standards for waterfowl seldom change and breeding to show standard would only endanger the utility side when a change in the standard for a breed was made. This would necessitate going outside a particular strain for fresh blood to make changes in stock to suit the new standard, or inbreeding for the characteristics of the new standard at the expense of other characteristics.

Breeding means reproduction — selective breeding is the selection of stock as individuals or families for improvement. The commercial duck-egg producer can either breed his own replacements from his own flock matings or buy in hatching eggs or day-olds from a breeder's flock-mated birds. The males in these flocks are usually periodically replaced by the introduction of drakes from a pedigree breeder.

The pedigree breeder builds up a family or strain either from individual birds, "individually pedigreeing" them, or from a small flock-mated pen of related and tested birds of known history and by "pen pedigreeing" until his strain is pure and has a low potential of variability.

INBREEDING

The pedigree breeder can either "inbreed" — i.e., use continuous matings of closely related birds — (full brothers with full sisters or father/daughter, mother/son, and even back to grandsires or granddams) or he can "out-cross" by buying in stock of another pedigree strain.

Without going into detail, the advantage of inbreeding is that desirable characteristics can be more easily fixed by giving extra doses of a specific quality by mating back to a parent that possesses it, or by mating together birds from that same parent.

If desirable characteristics are intensified by inbreeding, it follows that non-desirable characteristics must also become more pronounced, but once these are eliminated, the desired type of stock will have been obtained.

In trying to purify a particular strain, the breeder should resort to out-crossing only if a required characteristic has been lost, for although one desired characteristic may be obtained, many undesirable ones could also be introduced. Fresh blood should therefore be introduced to only a small part of the stock and should not be distributed further until it has been purified to the breeder's requirements.

LINE BREEDING

“Line-breeding” is the mating together of a bird with a given ancestor: grand-daughter/grandsire or grandson/granddam in each successive mating to purify the strain.

HYBRIDS

The current concept of hybridization is the crossing together of two usually highly inbred, or at least unrelated lines of the same breed or of two different breeds. By this method increased vigour and better production are obtained, but the progeny do not necessarily have better breeding qualities than their parents because of their increased performance.

THE NUCLEUS SYSTEM

In the “Nucleus” system of inbreeding, stock is divided into small groups of females, the stock in each group being mated to a separate male. The progeny of one group is compared with those of all other groups for its profitability and the female progeny in the most profitable group are divided into further groups and mated to half-brothers to form the breeding pens for the following season. Selection is carried on in this way in future generations. The system gives a test of males rather than of females, since all the progeny from each mating derive characteristics from the male parent, whereas only a few of the progeny have inherited characteristics from each female in the mating.

By this method selection is based on the average performance of a group, whereas in individual pedigree breeding the aim is to find individuals who have inherited above-average characteristics and are capable of passing these on. These are then mated together to provide stock which is above the previous average standard.

Whichever method of breeding is used the progeny are the only proof of the value of matings, and it is by their results that the breeder plans future matings. Of the numerous methods of breeding, inbreeding, line breeding and the nucleus system are those most commonly used in duck breeding.

Incubation

Ducks can show a high percentage of hatchability whether their eggs are hatched naturally (under broodies) or artificially, in incubators, provided that they have been bred and mated up correctly and given the right management as breeding stock. Management up to this point is, however, only half the battle. Care of the egg from the time it is laid until it is set to hatch is highly important.

DRY, CLEAN LITTER IS IMPORTANT

To keep the eggs from getting dirty it is advisable to have nest boxes lining the side of duck houses well littered out with clean, dry and frequently-changed straw. If nest boxes are not provided eggs are laid on the floor where the birds are continually moving about and making the litter dirtier

than that in the nest boxes where they go only to lay. It is important that the straw should be dry and clean, and not some that has been wet and subsequently dried out, because of the possibility of mould growth — one of the chief causes of incubation failures with duck eggs. If a blue mould is discernible on any type of litter it should not be used. The mould is in all probability *Aspergillus niger* or “black mould”, which can very quickly spread through an entire hatch to cause severe losses. The same growth causes *Aspergillus fumigatus* (brooder house pneumonia) in ducklings and chickens.

COLLECTION, WASHING AND CULLING

Eggs should be collected as soon as possible after they are laid, because from that time evaporation takes place rapidly and it is important that this should be checked as much as possible. Not only does evaporation affect hatchability because the embryo requires the correct amount of moisture, but as the contents of the egg contract disease germs are drawn through the pores of the egg shell.

Washing hatching eggs does not appear to have any detrimental effect on hatchability, but to avoid contraction, the water should be at a higher temperature than the egg itself (about 160°F). The eggs should be dipped as soon as possible after collection, using a disinfectant detergent in the water in accordance with the maker's instructions. Washing water should be changed frequently.

It has been said that eggs should not be washed but should be scraped or sand blasted because of the spread of disease germs from one egg to another in the washing water. Because of the extra humidity required for duck-egg hatching and the necessity of “sprinkling” and turning in small-type machines, there is little more danger of contamination at the cleaning stage by washing than there is during actual incubation. Eggs have to be handled one after the other during the scraping process which is unlikely to remove very many of the undesirable organisms on an egg.

When washing eggs, those unsuitable for incubating should be culled; these will include those with thin shells or rough uneven ones, shells with hair cracks, unusually large eggs which probably have double yolks, and those that are underweight, misshapen, or with noticeably “watery” whites.

GASSING AND SETTING

Prior to setting the eggs should be gassed, using 4½ oz formalin to 3 oz potassium permanganate per 100 cu. ft of gassing space. Eggs should be placed in an airtight container for gassing — if eggs are trayed for hatching and stored in an egg loader until set the ends of the loader can be sealed up. A container such as a galvanized iron food storage bin is useful for holding piles of eggs for gassing.

Eggs should be set in incubators as soon as possible after collection, since even with the best of storage facilities hatchability decreases daily after the first two or three days. As it is often impossible to have daily settings, to avoid contraction and expansion, eggs should be stored at as even a temperature as possible — approximately 55°F — and in a place where movement of air cannot cause low humidity and evaporation. If eggs are set on trays ready for incubating there should be no strong direct air current through the room.

If correctly stored, eggs can be held for hatching for up to ten days. If they are to be held for more than three days, although extra handling is

entailed, it is advisable to set eggs on their sides in boxes and surround them with a good thickness of chaff. They should then be turned or tilted daily through 180 degrees to avoid stuck "germs"; if the eggs are in boxes of chaff they can simply be reversed.

TESTING FOR DEFECTS

Before placing eggs in incubators "candling" or testing for other defects is worth while so that defective ones can be removed, allowing more room and air for good eggs. Candling is done by placing each egg or tray of eggs over a strong light and looking through the egg at the light. Apart from the defective eggs already taken out at washing time the following defects will be discernible by candling:

1. *Stale eggs*. These have a larger air space than usual and the yolk is more dense with an even outline.
2. *Eggs with meat or blood spots*. These show a red spot floating on the side of the yolk.
3. *Blood eggs*. These show a greater mass of a reddish tint.
4. *Watery whites*. Although not normally discernible these will be clearly seen when candling. The white looks as though there are one or more bubbles floating in it which change position as the egg is moved. These are thought to be due to storage in too high a temperature, but some birds will produce a run of eggs with watery whites probably because of a constitutional weakness.
5. *Eggs with "double yolks"*. These are often laid when birds first commence laying and the two or more yolks are easily seen with a light. Eggs with two yolks will seldom hatch and are best discarded.

THE INCUBATOR HOUSE

Points to be borne in mind are air flow, temperature, humidity, and hygiene, since all of these directly affect conditions in the incubator.

Before designing the incubator house, the type of incubator which will be used should be taken into consideration and advice obtained from the incubator manufacturer. If an existing building is being used, ventilators and baffled inlets should be installed in the right number and the right positions to ensure sufficient air flow. Unless the ventilators are fully automatic, the increased pull of air outside the shed during a gale is likely to speed up the passage of air inside, and, as hot air rises, any great difference between inside and outside temperature tends to increase or decrease air flow. It is therefore a great advantage to have ventilators baffled by an adjustable hinged flap and sliding doors fitted to the inside of inlets which can be partly opened or closed to suit air conditions.

The incubator house and incubator must be treated as a single unit when considering air flow. This flow should be continuous, without interruptions such as cross-draughts caused by doors or windows. If there is a cross-draught over the incubator the hot air will be checked as it rises towards the ventilators, air flow will then be checked in the incubator causing a build-up of carbon-dioxide and moisture.

The walls of the shed should be thick, preferably a cavity wall for better insulation. A ceiling will help to maintain the shed at an even temperature.

Incubators vary considerably and it is advisable to follow the maker's instructions for incubating duck eggs as opposed to hen eggs. A description is given below of the most successful method of hatching duck eggs in small, 150-hen egg hot-air machines. The general principles of management apply to all duck egg hatching; correct temperature, humidity at various stages

and air flow being the most important points in the running of any make of machine.

WASHING AND DISINFECTING THE INCUBATOR

The machine and house should first be thoroughly scrubbed down with a 4 per cent solution of common washing soda in water. This strength can be obtained by using a double handful of soda to a 2½-gal bucket of hot water, stirring thoroughly. Just before the start of the season incubators should be disinfected with formaldehyde gas using 4½ oz formalin to 3 oz potassium permanganate to every 100 cu.ft of air space. All air vents should be closed. The potassium permanganate is put in a container and then formalin poured on to this. The door should be closed quickly and, as the gas is most unpleasant, causing intense irritation to eyes and nose, the operator should withdraw quickly. Thermometers should be removed before gassing as this greatly increases the heat.

Incubators should always be disinfected at the beginning of the season, even though this was done at the end of the previous season. When all machines are out of use, usually at the wettest time of year, conditions are ideal for the development of mould growth.

When using small machines, eggs of approximately the same size should be selected for each tray. Because heat comes from above in most incubators other than forced-draught cabinets, if eggs differ in size, the temperature of larger eggs will always be slightly higher than small eggs on the same tray.

INCUBATOR ROUTINE

The following is the type of chart used for small machines and is most helpful when several machines are in use, since eggs set on different dates require different management. The hatch and cull records on the reverse of the chart are used as a guide when selecting future breeding stock.

INCUBATOR CHART

For use with 150 H.A. Type Incubator using three felts, one felt remains throughout. Temperature throughout 102–103°F.

Breed.....

Incubator No.

Total Eggs Set

Date Set

Date due

Date	Day	Remarks	Temperature					
			8 a.m.		3 p.m.		8 p.m.	
			Inc.	Rm.	Inc.	Rm.	Inc.	Rm.
	1	Day eggs set						

1st day: eggs set.

2nd day: commence sprinkling once daily (3 p.m.) turning and shuffling twice daily 8 a.m. and 8 p.m. up to the end of the 14th day.

7th day: test eggs.

14th day: test eggs.

15th day onwards up to end of 23rd day: sprinkle three times daily (turning and shuffling as before).

20th day: remove one felt.

24th day: Remove second felt. Remove dead germs. Canvas in nursery draw and corner of holding tray should be soaked in hot water. Pour boiling water over the nursery drawer. Put eggs to be pedigreed in bags, sprinkled with water, in the hatching tray. Close up the incubator and do NOT open till hatch is complete.

The above shows headings for an incubator chart. Cross lines should be ruled to allow for 28 days which are marked consecutively under the heading "Day". The remarks shown below the heading are put in the column opposite the appropriate day.

REVERSE SIDE OF CHART

HATCH RECORD

<i>Dam's No.</i> (If pedigree)	<i>Eggs</i> <i>Set</i>	<i>Fer.</i>	<i>1st Test</i>		<i>2nd Test</i>	<i>Hatched</i>		<i>D.I.S.</i>
			<i>Inf.</i>	<i>Dead</i>	<i>Dead</i>	<i>M.</i>	<i>F.</i>	

Totals.....

Fer.=Fertile. Inf.=Infertile. M.=Male. F.=Female. D.I.S.=Dead in Shell.

CULLS RECORD

<i>Dam's No.</i>	<i>Colour</i>	<i>Deformities</i>	<i>Weakness</i>	<i>Disposal</i>

Having run the incubator at the correct temperature as given by the makers when empty, the eggs are set and, to avoid too rapid an increase in temperature, the doors of small machines should be left open for about an hour. Eggs should be set in the morning so that the temperature can be adjusted correctly before the machines are left for the night. Moisture pans should have been filled just prior to setting, or as eggs are set.

The chart is practically self-explanatory, but there are one or two points that are worth noting with regard to the amount of moisture and method of sprinkling. During the first few days there is little evaporation if incubator house conditions are right, and sprinkling should be very slight. When it is noticed that evaporation in the moisture trays is increasing, sprinkling should be more thorough. During the last week sprinkling should be really thorough.

A plentiful supply of air with increased moisture to give correct humidity is preferable to a sluggish movement where evaporation is slow.

TESTING FOR BAD OR INFERIOR EGGS

On the chart definite days are given for thorough tests. In small machines it is often easy to pick out eggs which have gone bad between tests. Duck eggs are quite easy to test by holding a strong light under the tray of eggs and looking down "through" the eggs at the light. Eggs can be tested on the 3rd or 4th day of incubation if done quickly, but to avoid undue chilling of the eggs it is best to test on the seventh day when germs are more easily discernable.

In the first test remove:

infertile eggs (which are quite good for cooking). These look like a fresh egg with the usual round yolk,

eggs with broken yolks (can be caused by too rapid increase of temperature in the early stage). The yolk is indefinite in shape and more dense than in a fresh egg.

Dead germs. On the seventh day these appear as a thin red streak or as a red circle.

Any eggs with hair cracks.

The living germ at this stage looks like a pink spider floating on the side of the yolk.

On the 14th day the dark body of the live duckling can be seen, with big blood vessels. A lot of movement of the living embryo is now apparent and a live germ can hardly be mistaken for a dead one. The dead germ will vary in appearance according to the stage at which it died. The egg will however appear very much lighter in colour than normal, or the dark mass will be smaller and no movement will be seen.

On the 24th day the “live” egg looks at first glance like a solid black mass right up to the air space which is now very much enlarged and has extended down one side. On closer inspection, a slightly less dense portion can be seen at the edge of the air space, and by watching this the embryo can be seen moving. Germs which have died recently can be detected by a yellow band around the air space or by the fact that the dense black part does not extend to the narrow end of the egg.

If at any time a black or blue spot shows through the shell above the air space, mould growth can be suspected. It is advisable to remove any such egg from the vicinity of the incubator and to open the shell above the air space. If the air space membrane is covered with a powdery blue mould this is “black mould”. Other eggs should not be handled until the operator’s hands have been washed. The incubator of eggs should be disinfected with formaldehyde gas. A thorough cleaning and disinfecting of the incubator should be carried out after the hatch and the trouble traced to its source.

WHAT CAUSES POOR HATCHES?

A few of the causes and results of poor hatches are given below:

<i>Cause</i>	<i>Result</i>
Temperature too high at commencement of hatch. Temperature too high towards the end of hatch.	“Smudgy”—burst yolks; excessive number of almost clear eggs. Ducklings fully formed but fail to hatch. As embryo becomes very active at pipping time temperature increases quickly and adjustments of dampers (where these are in use) have to be made to keep the temperature down to the normal. Failure to hatch can, however, be inherited.
Humidity too low at hatching time.	Ducklings start to pip but die; eggs pip at one point only instead of around the egg; the bill of a dead duckling protrudes through a single hole; ducklings that do hatch have pieces of shell sticking to them; egg shell hard and thick, membranes too tough; smaller than average ducklings.
Humidity too high at hatching time.	Ducklings fully formed but die before pipping; these and ducklings that hatch appear slimy.
Temperature too low throughout hatch.	The hatch extended beyond the normal 28 days.
Temperature a little too high throughout hatch.	Ducklings hatch early.

Brooding

The brooding of ducks intended for both table and egg production is similar. The brooding period extends from day-old until the duckling requires no further heat — usually up to 3 weeks according to the time of the year.

Brooding may be either natural or artificial.

NATURAL BROODING

If only a few ducklings are needed they can be brooded under hens. They can either hatch them from fertile eggs or be given them at a day old. The most suitable type of bird is either a heavy breed or a heavy breed cross, since they are better sitters, better mothers and will cover more ducklings. Whatever variety is selected they should be de-loused before use with a good dusting powder. The usual wooden or metal coop will only be of use for a few days, as the ducklings will grow rapidly and they will soon find difficulty in getting through the slatted front. A small house is preferable, say 6 × 4 ft and this can still be used after the hen is taken away when two or three broods can be accommodated together. A large bird will cover about 11 eggs or she will take 10–15 ducklings. This may seem rather a large number but after a few days the ducklings will need only a little heat, and may not even sit under her very much after this. The floor can be covered with sawdust, peat moss, chaff or short cut straw and renewed daily, particularly as the ducklings grow. Food and water should be placed in the house for the first few days and then taken outside, and to prevent them from wandering a surround of some kind such as wire netting should be placed around the house. After 2–3 weeks the ducklings will need no further mothering and the hen can then be put back with the rest of the laying flock.

Where large numbers are required, artificial brooding is the only practical and economic method to adopt.

ARTIFICIAL BROODING

Artificial brooding can be achieved by hot water or infra-red heating, by hovers, tier brooding, radiant heat, outdoor brooding or the cafeteria system.

HOT WATER METHOD

The house is usually divided into sections which are serviced from a main corridor running the entire length of the house. Each section contains a brooder, in the form of a flat radiator placed about 6–8 in. above the floor. A canopy is placed over it under which the ducks sit, and this is raised as they grow. The hot water that supplies it can be heated by coal, coke, gas or electricity. To adjust the temperature, thermostatic control of some kind is used, and also stopcocks on the pipes leading to each compartment to turn off the supply of water when necessary.

This system was popular previous to the last war, but the expense of installing it now very much limits its use. However, where there is a large weekly output, it is still a very convenient method.

INFRA-RED HEATING*

During recent years this system has become increasingly popular. Its advantages lie in the fact that it is cheap to instal, easy to run, and free from many of the trappings associated with other systems, whilst the tendency to overcrowd is not nearly so great. There are three types available; the bright and dull emitters, and one heated by paraffin. Whichever is used is to some extent a matter of personal preference, but some people think that the rays of the bright emitters destroy certain vitamins in the food. As a precaution, therefore, the hoppers should be placed away from the direct rays. The dull emitters should be fitted with a pilot light to show when the heat is on or off. It is customary to allow 30–40 ducklings to a 250-watt bulb.

The ducklings are weaned off heat by gradually raising the lamp so many inches every day. How much and how often this will be, depends on the weather and the time of year, but before being cut off altogether, it should first be switched off during the day and continued for a few nights.

Infra-red heating will only be satisfactory if the house is well constructed, since the system affords no protection of any kind against draughts, and unless this is realized high losses will inevitably occur.

HOVERS

These are not now so widely used although they can be heated by electricity as well as paraffin, but where paraffin only is available they serve a useful purpose. The lid is usually of cone-shaped metal held up by a fairly substantial wooden frame (Fig. 1). It is essentially a piece of indoor equipment needing a house to accommodate it. Metal sides and curtains help to keep in the heat and these are gradually removed as the ducklings grow, although in the hot weather they will probably not be needed at all. The advertised capacity is usually for chickens, but as ducklings grow so much more rapidly this number should be halved. Wire floors are sometimes placed underneath the hover which will help to keep the ducklings dry.

Other heating systems have gradually tended to replace the hover because much more labour is needed to fill containers with paraffin, trim wicks, etc., and the possibility of fire is a constant worry.

TIER BROODING

Either battery or tier brooders can be used for this system.

Battery Brooding (See Plate IV (lower))

In many ways this is the most suitable method for large-scale farming, since large numbers of ducklings can be kept in a relatively small space, and losses as a result of vermin are greatly reduced, if not eliminated. Paraffin, electricity, gas or hot water can be used for heating.

The batteries are made of metal, although certain types combine some wood as well. They are generally arranged in three tiers, and each compartment has a wire floor and dropping tray underneath, the food and water being placed around the sides. A compartment measuring 4 ft × 2 ft 10 in. will hold 40 ducklings to 10–14 days. After this time they are normally moved to coolers without artificial heat (Fig. 2). These are similar in construction only higher, and a 4 ft × 2 ft 10 in. cooler would hold approximately

* See Plate IV.

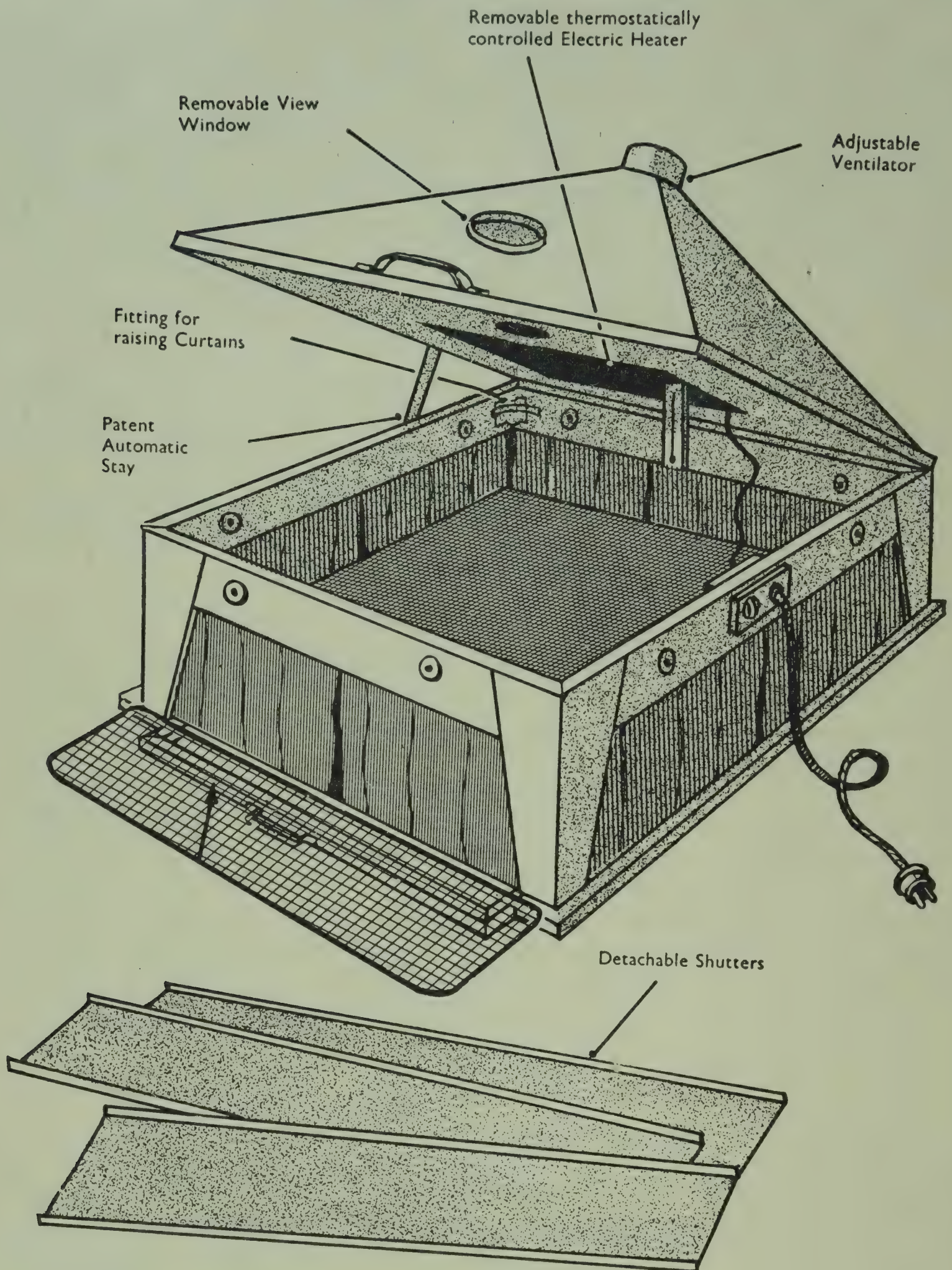


FIG. 1. Thermostatically-controlled electric pyramid hover

25 ducklings to 3 weeks. Clearing can be simplified by automatic means similar to those used in hen batteries.

Tier Brooding

This is a modification of the battery system, and the brooders are similar in basic principle, but they are not so closed in. There is a heated compartment at one end with a wire run attached, which the ducklings use after a few days. They can be purchased as a single- or a two-tier; the latter type 3 ft 6 in $\times$ 7 ft will accommodate 100 ducklings to 10 days.

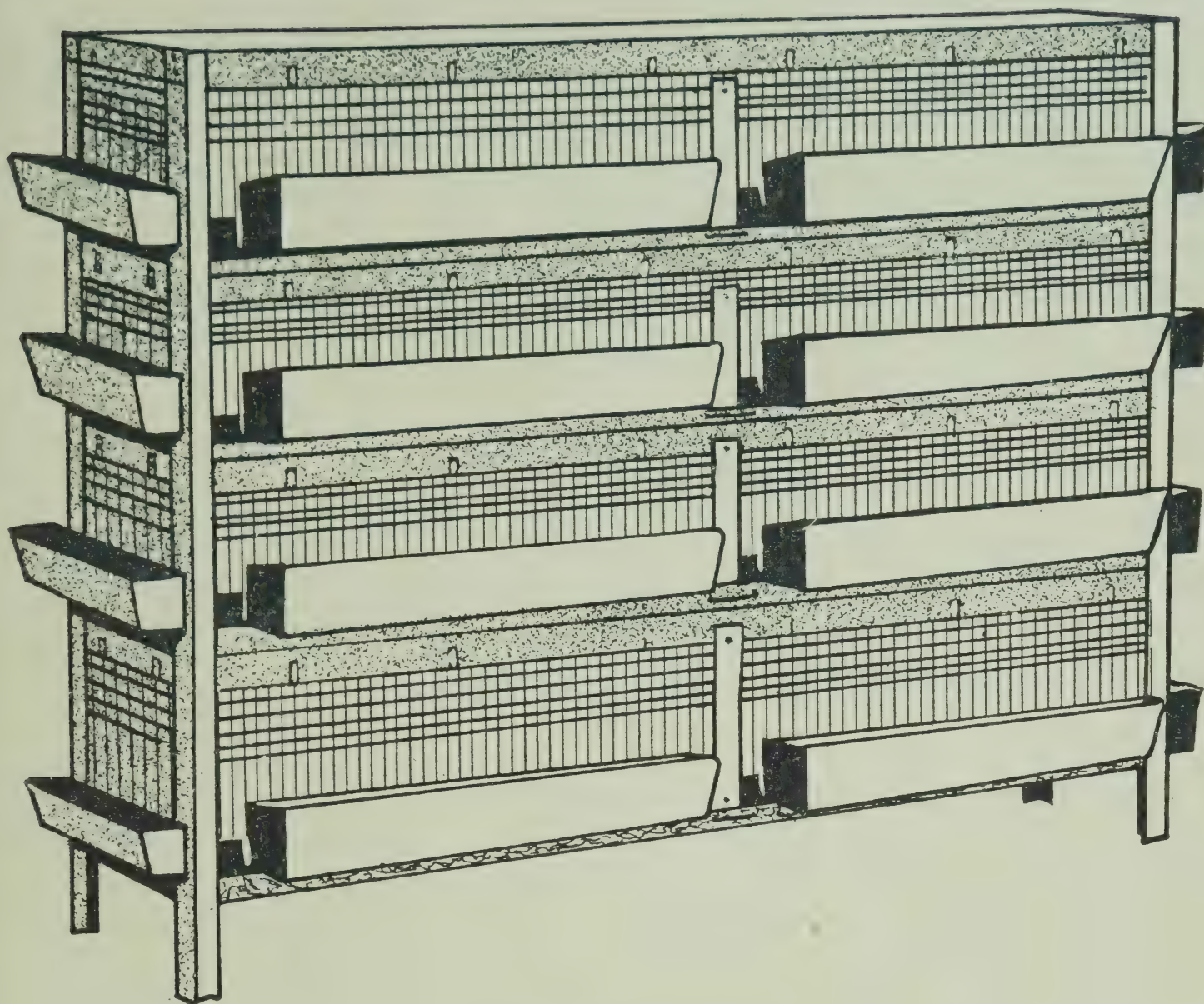


FIG. 2. Chick cooler

RADIANT HEAT

This system is not popular because of the cost, but where large numbers are produced it has been used with success. Hot water pipes are imbedded in a concrete floor, and the hot water supplied to them is heated by a boiler. As the floor is kept continually dry no litter is needed. The system is labour saving and the ducks do well, but crowding is always a danger if the ducklings are frightened.

OUTDOOR BROODING

This type of equipment is not usually associated with duck brooding but it has been adopted with good results. A verandah is attached to the brooder and the ducks have access to it after a few days. About a third of the floor area, which can be of wood or strong wire, is used for the heating compartment and the rest of the brooder acts as a covered run which accommodates the food and water. Access to the inside is by a sliding door in the roof. Growth rates are claimed to be most satisfactory and the ducks are hardy and healthy. Where there is no electricity, outdoor brooders are most useful, as they can be heated by paraffin. There is, however, considerable work in servicing the units, and this can be unpleasant in bad weather, as there is much scrubbing to be done between batches. The ducks are split up as they grow and they are moved on to the ground at three weeks or so. A brooder measuring 9 ft $\times$ 3 ft will hold 100 ducklings provided that they have access to a verandah at 2-3 days old.

CAFETERIA SYSTEM

A cafeteria battery unit has been used for rearing with remarkably good

results. The ducks are moved from battery brooders at 14 days and placed 5 in a cage which measures 21 in. $\times$ 10½ in. The ducks soon settle down and then spend their time waiting for the conveyor to pass with food and water. Pellets are used exclusively. The droppings fall into a gulley, made at the end of the block of cages, and at intervals this is washed down forcing the droppings into a concrete soakaway built in the ground outside the house. The outstanding features of this system are a very appreciable reduction in labour costs, easy disposal of manure, and being able to keep large numbers in one unit.

MANAGEMENT

Whatever system is adopted, provided that it is intelligently applied, the rearing of ducklings is not difficult as they respond favourably to good management. The main points to remember are adequate heat, suitable housing, and balanced diet.

HEATING

The ducklings should be taken from the incubator as soon as they are dry and kept in a temperature of 80–85°F during the first few days, reducing it by 5° every 2–3 days according to the weather. During the summer it can be cut off altogether at 10–14 days, but in cold weather it may have to be continued a little longer although not for more than three weeks.

To prevent the ducklings from wandering, a surround of some kind should be used. It can be either corrugated paper, flat galvanized sheeting or even straw bales. The ducks will show whether they are warm enough by either settling down in a ring around the source of heater, if they feel in any way chilly, by tending to crowd one on top of the other.

BROODER HOUSES

With infra-red heating and with hovers, individual portable houses can be used, but for hot water, tier and battery brooding, a brooder house of some kind is necessary. For chickens and turkeys, a wooden floor is preferable, but as ducks waste so much water in drinking, a concrete floor is recommended. The house itself can be of concrete blocks, bricks or timber. As far as information is available, insulation does not seem to play an important part in duck housing, and provided that the house is not too high, and is draught proof, it should be quite satisfactory.

The usual design of a brooder house where battery brooding is not adopted consists of a corridor approximately 3 ft wide running down one side with pens leading off from it (Fig. 3). A centre gangway with compartments on both sides is perhaps more convenient, but this would make the house rather wide which would add to the cost. Windows arranged in the front of the buildings should be designed so that they open easily and the partitions between the compartments need only be 1½–2 ft high. Sun parlours are often attached to the front of each compartment, and one measuring 12 ft $\times$ 5 ft will hold 100 ducks to a month old. Where batteries or tier brooders are used, they can be arranged in rows with convenient spaces about 2–3 ft between each, thus allowing for ease of cleaning and for getting about in relative comfort. (Conveniently placed roof lights will enable sufficient light to penetrate between the block of brooders). In this system

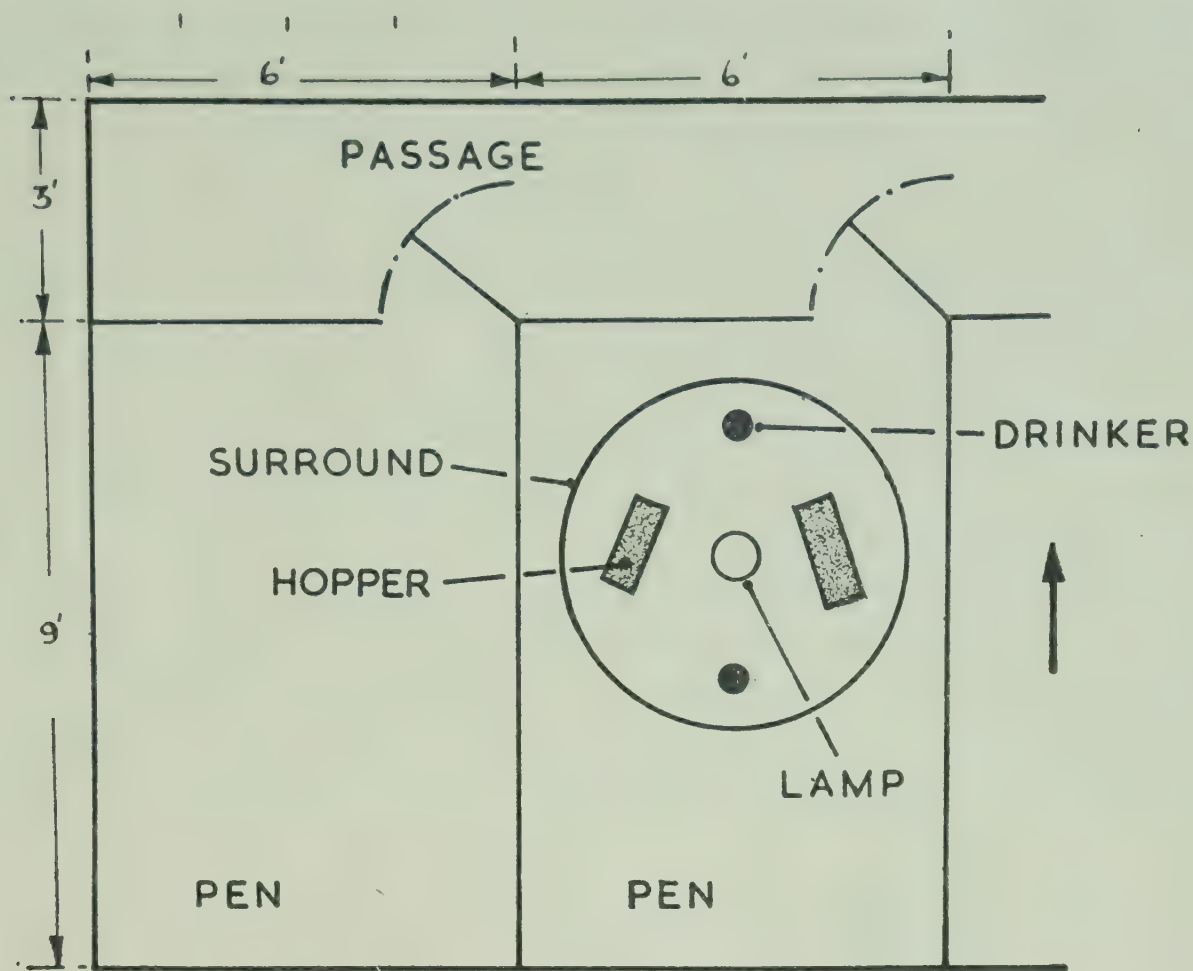


FIG. 3. Brooder house layout

ventilation becomes an important factor. As so much water is drunk or spilt by the ducklings, the atmosphere inevitably becomes humid and this can reasonably be conditioned by the use of electrically-driven extractor fans with the appropriate amount of inlet area. The size of both fans and inlets will be according to the makers' recommendation.

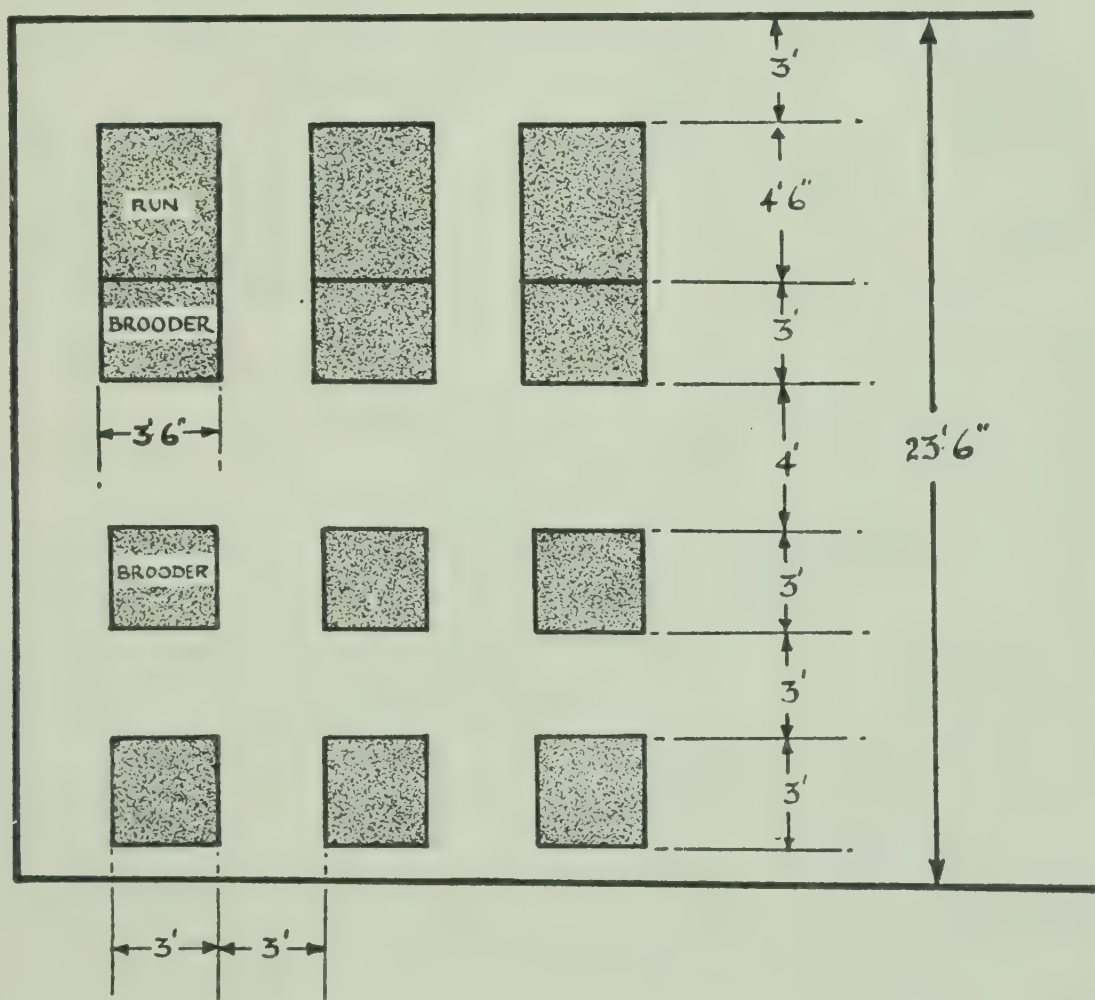


FIG. 4. Battery house layout

Siting of the brooder house is important. It should be placed reasonably near to the service buildings, near a good road, and close to the farmhouse.

All young stock need a lot of attention when they are very small and it is advisable to look at them frequently. This applies particularly to the last call that should be made before going to bed each night.

WATER SUPPLY

Clean water in suitable containers is important. Ducks are very fond of water, but they should not be allowed to get too wet, particularly in the early stages. The drinkers should be sufficiently deep for them to immerse their heads but not their whole bodies. If they cannot do this, their eyes seem to get scaly and crusty, and, in extreme cases, blindness may follow. They also like to clean their bills periodically and to wash them clear of food. For the first week or so, small metal founts are useful and their size should be increased as the ducks develop. After 2–3 weeks, automatic watering can be installed provided there is a grid over the top to prevent the ducks paddling in it. The utensils should be scrubbed daily; if this is neglected the mash that falls from their bills will ferment, particularly during hot weather.

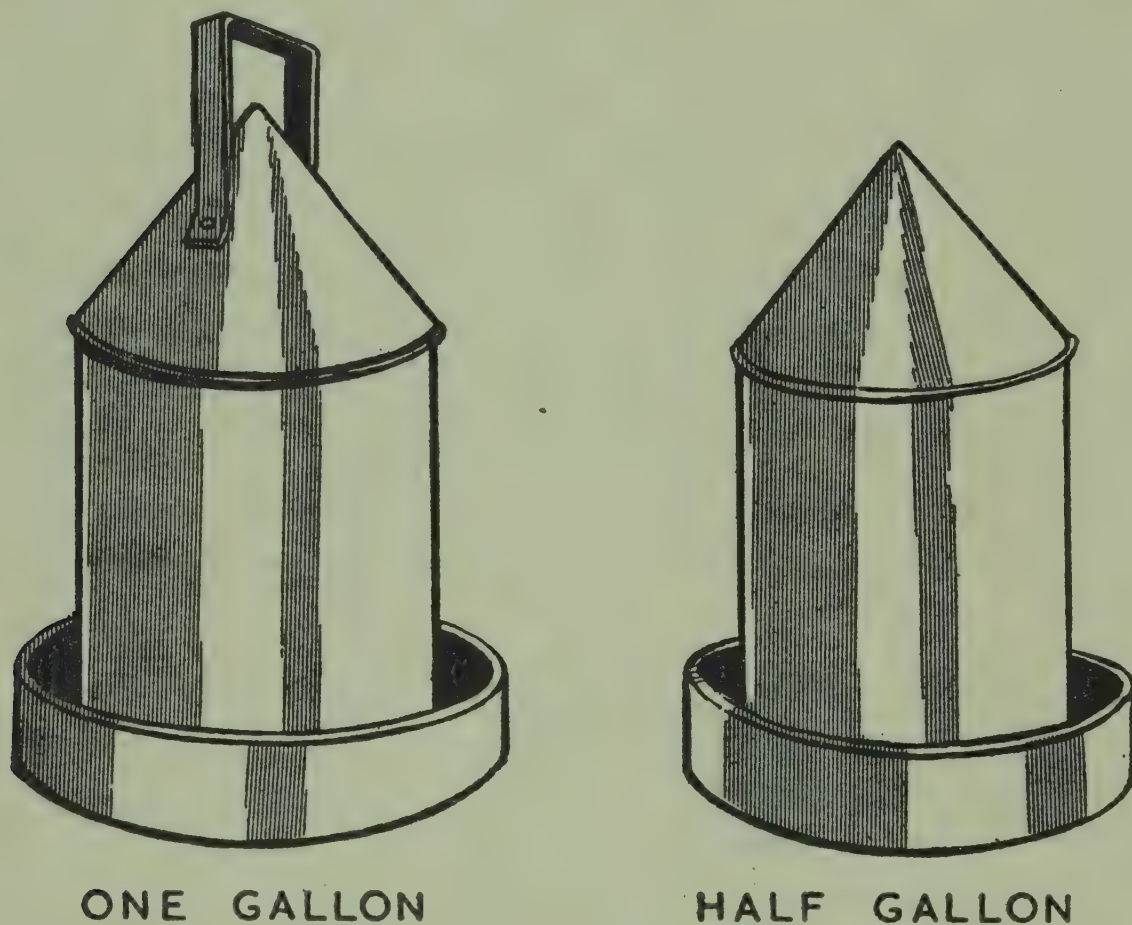


FIG. 5. Drinking founts

PREVENT OVERCROWDING

Ducks grow very quickly and consequently it is very easy to overcrowd. The fact that they quadruple their weight within four weeks gives some indication of the accommodation they need.

0–3 weeks	50 sq. ft of floor space	} per 100 ducks
3–6 weeks	130 sq. ft of floor space	
6–10 weeks	300 sq. ft of floor space	

It is not advisable to put more than 200–250 ducklings together; a greater number than this could be difficult to handle, and the ducklings might damage themselves.

Birds that have been overcrowded will show a wide range in size; they will be underweight as a group, vices will tend to become aggravated, and they may appear to be excessively nervous. Ducks tend in any case to be nervous and they should not be upset or frightened. Banging doors and

buckets or any sudden movement will put them into a panic which will cause the death of some.

BALANCED DIET

Food can be given as soon as the ducklings are put into the brooder. This can either be crumbs or wet mash. There is much to be said in favour of crumbs ($\frac{1}{8}$ in. size) and they do seem to give satisfactory growth rates when fed *ad lib*. Apart from saving labour they are much less wasteful, easier to handle and cleaner to use; furthermore there is less danger of fermentation during the summer months. If wet mash is given, it should be mixed to a crumbly consistency and fed for the first week at the rate of five meals per day, reducing this gradually to four, and eventually to three. Each meal should consist of as much food as the ducklings will clear up in 10–15 minutes. In order to get even growth, adequate eating space is important. With wet mash feeding, sufficient should be given to enable all the ducks to eat at once. As a guide, allow approximately 18 ft for crumbs, and 24 ft for wet mash, from 0–3 weeks per 100 ducks.

A starter diet is seldom compounded for ducks, and a good chick ration appears to be quite suitable for the first 2–3 weeks. If the ducklings are on the floor, small metal troughs can be used straight away, filled with either wet mash or crumbs, and if they are placed near to the brooder the ducks will soon find them.

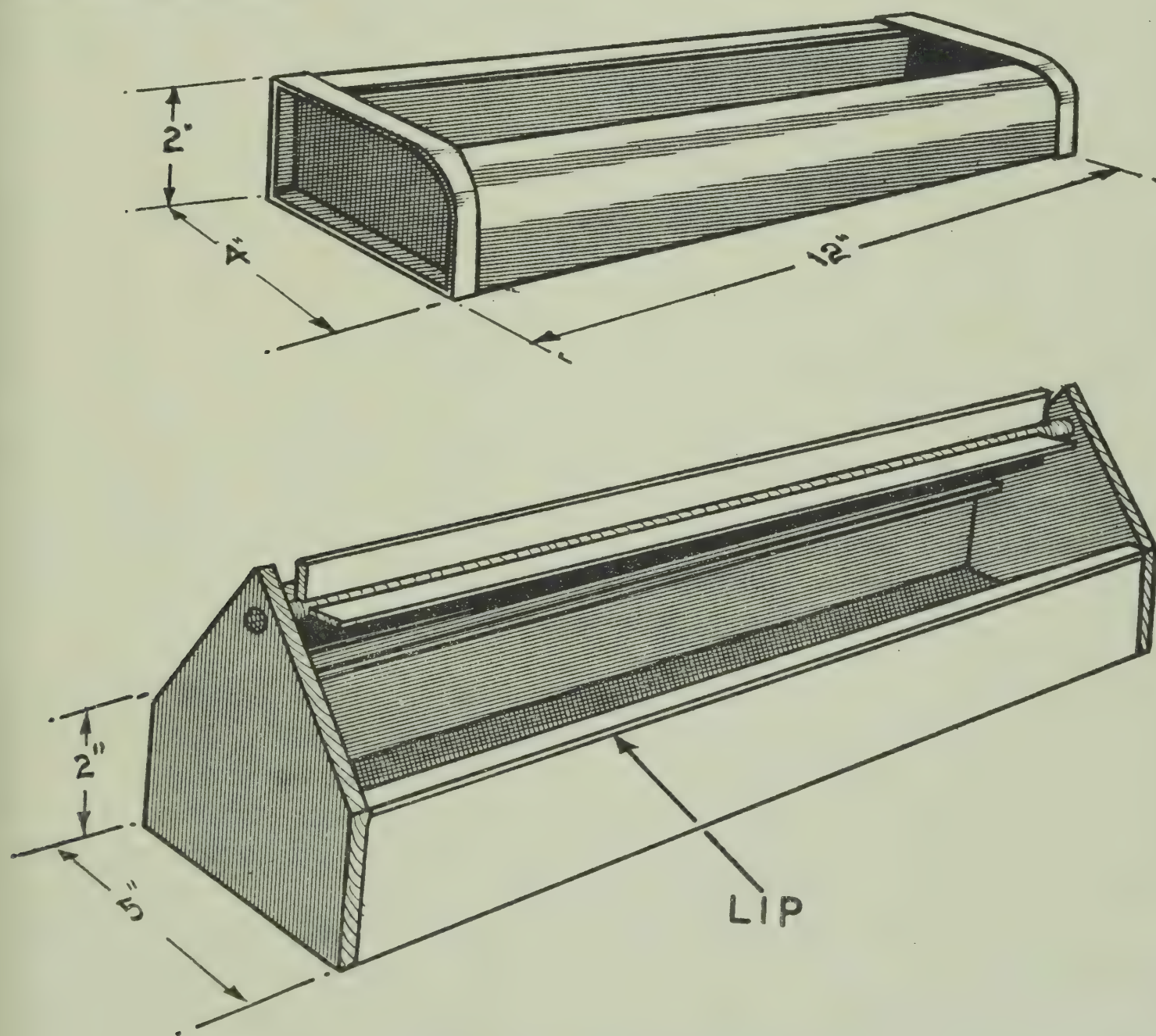


FIG. 6. Feeding troughs for ducklings
 Above: For wet mash
 Below: For crumb feeding

The following ration can be fed to ducklings from 0-3 weeks:

	<i>cwt</i>	<i>lb</i>
Coarsely-ground wheat	2½	
Finely-ground barley	1	
Finely-ground oats	1	
Maize	3	
Dried grass	½	
White fish meal	¾	
Extracted decorticated ground-nut meal	¾	
Unextracted dried yeast	½	
*Ground limestone		14
*Manganized salt		3½
Vitamins A, D ₃ +Niacin supplements to supply		
Vitamin A	1,500,000 I.U.	
Vitamin D ₃	150,000 I.U.	
Niacin	30,000 mg.	

* or Minerals according to the makers' recommendation.

LITTER

Peat moss is superior to any other litter as it is very absorbent, but it is expensive and many rearers prefer the cheaper shavings or sawdust. Whatever type is used it should be changed frequently, particularly under the hover or where the ducks sleep. Chaff, cavings, or cut straw can be used as the ducks get older.

Both for table and egg production, the age at which ducklings are put on to the ground will vary to some extent with the system, but generally it is at 3-4 weeks old. At this stage they should be sufficiently hardy, even during the winter months.

SEXING AND MARKING

There are three methods of distinguishing between males and females.

At day old and as soon as the ducklings are dry the sex can be determined by examination of the vent. The ducklings should be held in the left hand with the head hanging down between the fingers. The vent should be opened by pressing with the thumb and first finger of the right hand and the male organ can easily be seen appearing as a small projection. It is a much simpler job than with chickens and a certain degree of accuracy can be achieved after only a little experience.

There is also considerable difference in the voices of the duck and the drake even as early as 6-8 weeks. The former has a definite "quack" whilst the drake's seems to be lower pitched and slightly rougher in sound.

When the drakes have grown their adult plumage, some of the tail feathers curl whilst those of the female show no such tendency. This, incidentally, does not apply to the Muscovy.

In order to trace the origin of ducklings, two methods of marking can be used (Fig. 7). The first is by punching or cutting the web of the foot or feet, which will ensure that the ducklings can always be traced to the pen. Each foot has two webs and there is also a smaller flap of skin along the sides. Holes can be made with a toe punch or the web can be split by using a sharp knife, scissors or a razor blade. It must be a clear cut otherwise the

two sides may grow together again. There are many combinations of marking that can be used.

If pedigree work is done small bands called wingbands or wingtabs are attached to the flap of skin that stretches across the inner part of the wing. These are numbered, and in this way the origin of the ducks can be traced to dam and sire. When trap-nesting is carried out it is easier and quicker to record if the duck is ringed by using a numbered leg band.

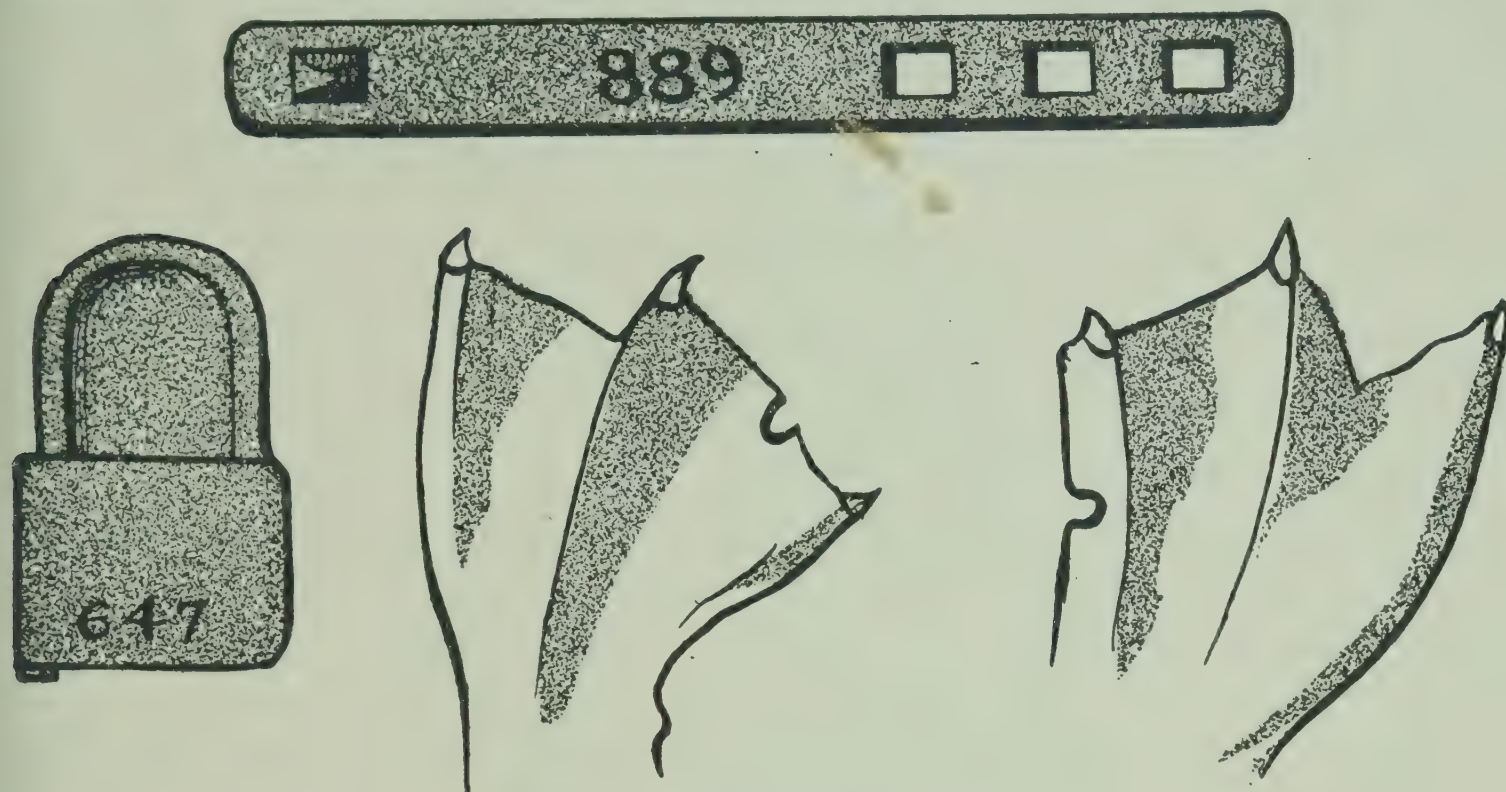


FIG. 7. Marking methods
Top: Legband
Bottom left: Wing tab
Bottom right: Web punching

Table Varieties

REARING

Norfolk has been the leading table-producing area for many years, and although expansion has taken place there and elsewhere, the industry has undergone few major changes.

The three methods of production are:

Completing the whole process on one farm, i.e., breeding, hatching, rearing and fattening;
 Purchasing ducklings at day old and then finishing on the same plant;

Buying eggs and hatching either at a farm or hatchery. The ducklings are sold when they are from 0-6 days old and then kept by the rearer until they are 3 weeks old and disposed of to the fatterer for finishing.

The question of disease has to some extent always influenced production methods, and where different establishments are responsible for each stage there is a better means of control. This applies in particular to two diseases, those of the salmonella group and virus hepatitis.

HOUSING

Small numbers of ducklings can be reared quite successfully in grass pens, and a house measuring 12 × 8 ft will accommodate 60-70 ducklings up to 6-7 weeks; the runs should measure approximately 22 yd square. Housing

is not strictly necessary, but it does give some protection during adverse weather. Even if it is provided, ducks will often ignore it, preferring to sleep out in the open.

Food troughs and water drinkers should be placed in the runs under shade and if possible they should be moved regularly. Food troughs of the "V"-shaped type are suitable for wet-mash feeding, allowing 40 running feet per 100 ducks. The round metal ones used for laying hens seem to be quite popular for pellets, allowing four $\frac{1}{2}$ -cwt size per 100 ducks.

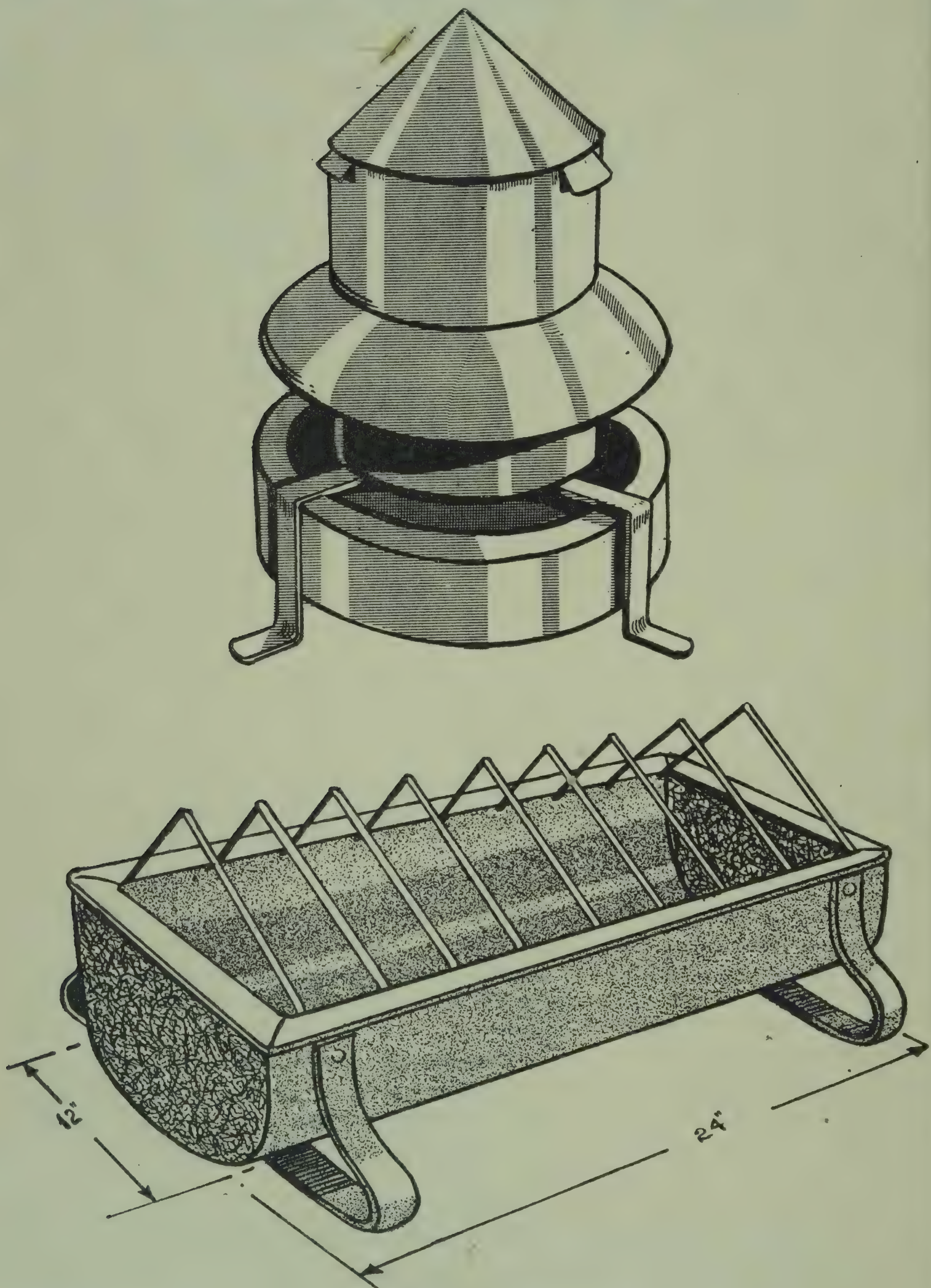


FIG. 8. Two types of food trough

It is advisable to have alternate runs if the houses are permanently fixed. It is not easy to keep them in good condition as ducks love to burrow down with their bills in search of worms, etc., and the result is a very uneven surface. The grass should be kept short, otherwise parasites may harbour in tall, uncut areas. As soon as the surface looks worn, the runs should be changed over.

Ducks can remain in the same house for fattening, but it does help if they are confined to straw yards which can be placed in front of the houses. They should cover approximately the same area as the house, i.e., in this case 96 sq. ft. The straw should be renewed every few days, and then every day just before killing commences, to keep the ducks clean.

DANGERS THAT BESET DUCKLINGS

As with the more intensive methods, vices tend to become aggravated. "Pulling" of the down is one that many farmers have to contend with, and it can reach very disturbing proportions. There seems to be no real answer to the problem. Overcrowding, lack of water, sporadic feeding, use of pellets, and dry weather, have all been suggested as possible causes. Not only is the appearance spoilt but the ducks do badly and they are easily damaged.

Any undue upset from the fattening stage onwards will have a retarding effect on the ducklings. If they are frightened, too frequently handled, or herded together they will often become quite lame and have difficulty in getting about. This is a nervous condition which will disappear in a fortnight or so; the affected birds should not be taken out but left with their pen mates.

Various kinds of vermin attack small ducklings. They are particular favourites with rats who will play havoc with them in a very short time, and stoats and weasels are also dangerous enemies. Crows will readily kill young ducklings by decapitating them. They swoop into the pen and kill quickly leaving the remainder excited and frightened.

LARGE FLOCK REARING

Although the modern trend seems to favour running not more than 200–250 per pen where ample land is available of the light sandy type, ducklings undoubtedly do well in large flocks, if they are put onto the ground at 3–4 weeks of age. They soon become hardy, and apart from some form of shelter against sun and storm, only a 2-ft wire netting fence is needed to control them. The shelter can be made of corrugated iron sheets, or asbestos placed over straw bales, and will probably be used during the first few days only; after this, provided that there are no foxes, the ducks will sleep out in the open.

If the runs can be moved frequently, heavy stocking is not detrimental and as many as 2,000 ducklings an acre can be folded. This system plays an important part in the programme of many East Anglian farmers and they claim heavy yields after the land is ploughed and sown behind the ducks.

FEEDING

With large flocks it is quite impossible to use troughs if wet mash is fed, so the food is usually thrown on to the ground. This may seem to be unhygienic and wasteful, but is the only practical way of tackling a very big job. Wet mash mixing machines are used and the food is conveyed to the

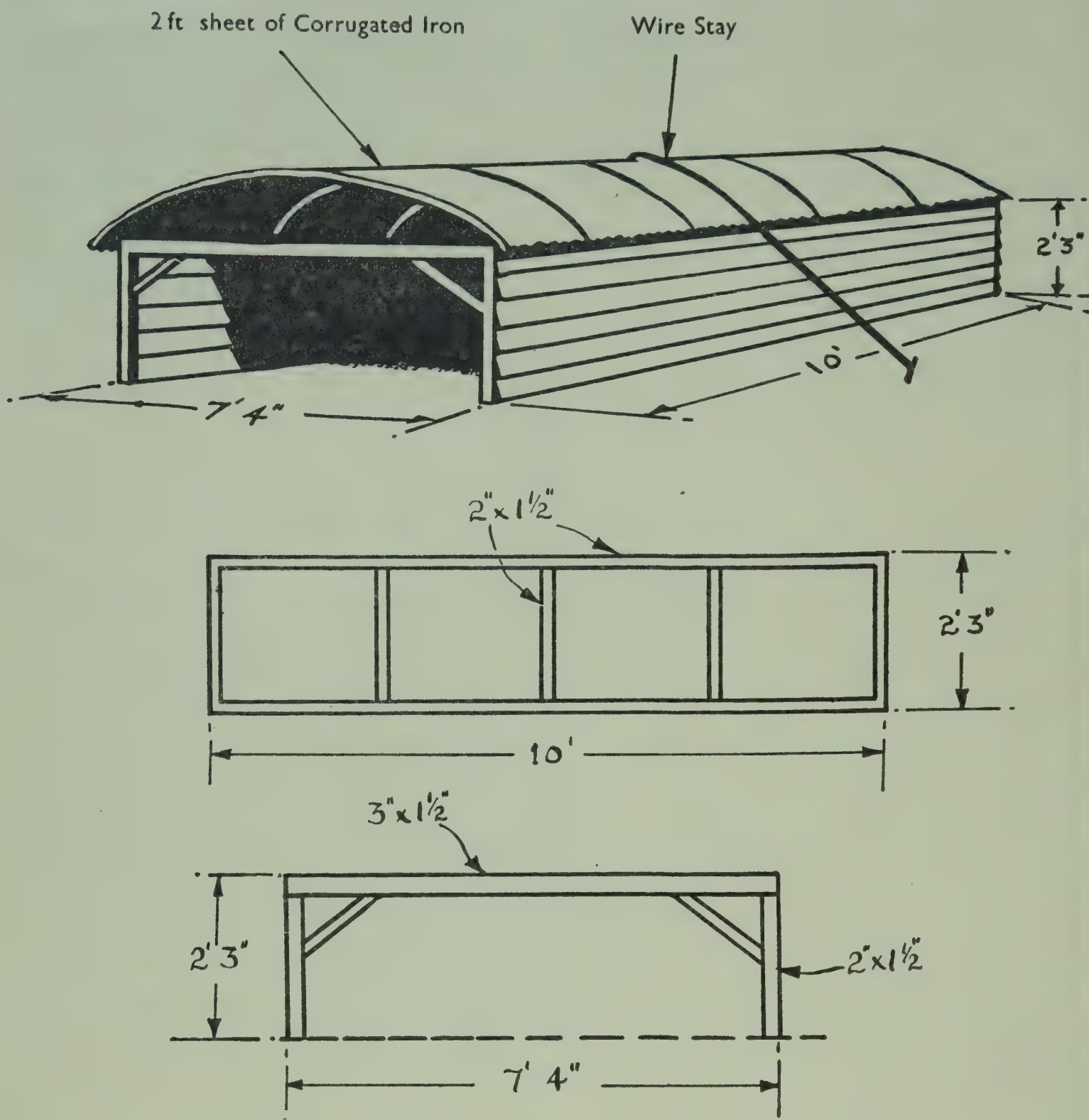


FIG. 9. Shelter for 100 ducks

fields by tractor trailer usually twice a day. In more recent years, pellets have become popular, and during rearing, growers' pellets are widely used. These are economic only if they are fed in large hoppers holding at least a few hundredweights. (See Table I on p. 37). Moreover, full benefit is received for bulk delivery and this ensures cheaper food with less labour costs.

Where water is laid on to the fields, troughs can be fitted with ball valves to ensure a constant and automatic supply. If main water is not available, tanks filled periodically can be connected to the troughs by flexible tubing.

Ducks, we are told, will eat anything, only goats will outdo them. No doubt during the war years and for some time after, they did have a very varied diet, but a better duck will be produced in a shorter time if it is fed on a properly balanced diet throughout.

Outdoor feeding of any kind inevitably attracts wild birds. Large flocks of these are a constant menace as possible disease carriers, as well as consumers of large quantities of food and a real concern to the duck rearer. This problem still remains unsolved because of the obvious difficulties in combating it.

At the end of the growing period and before fattening commences, the ducks intended for stock should be segregated and fed on a cheap diet until

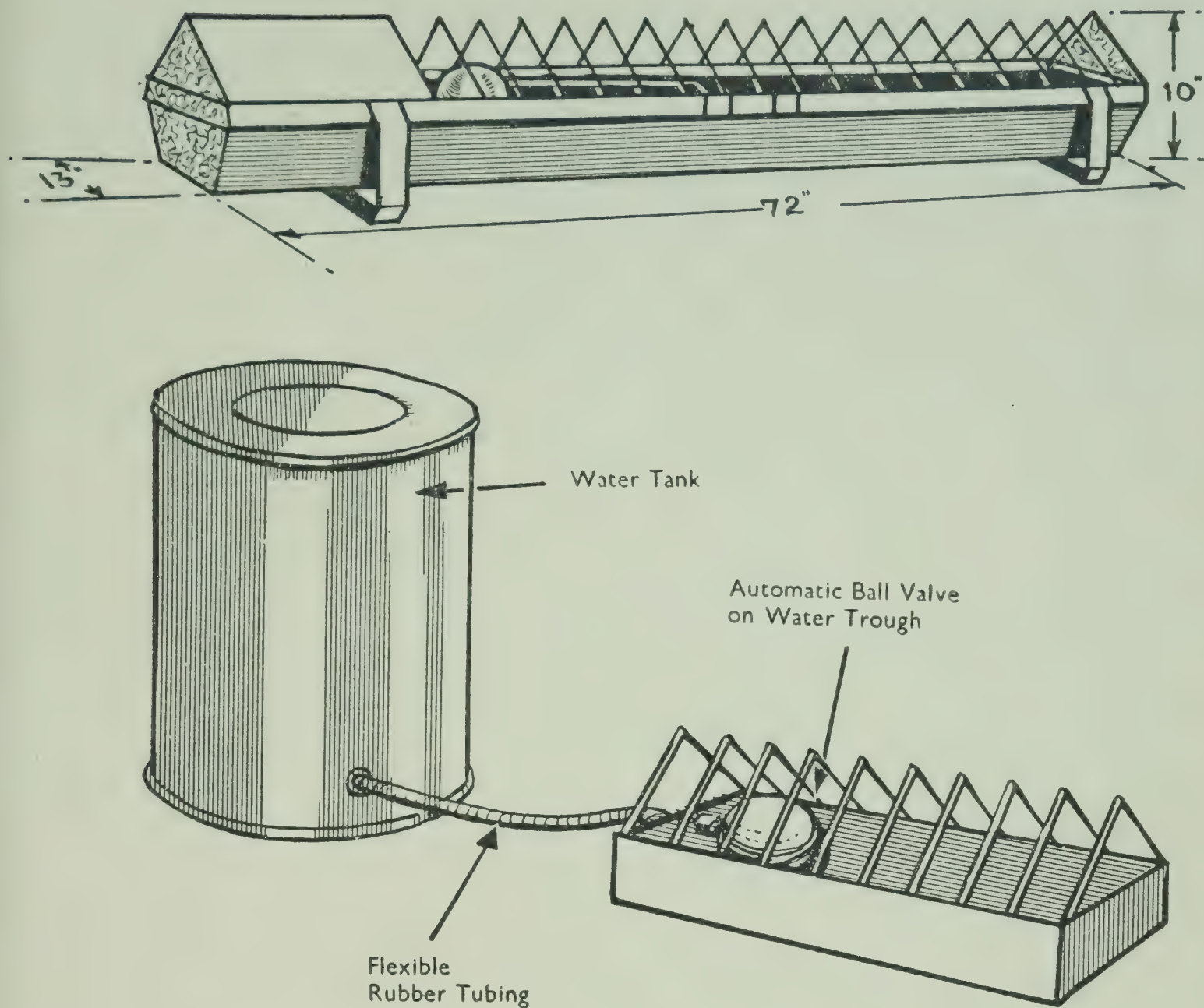


FIG. 10. Automatic watering to mains or barrel
In the lower drawing, the tank is filled periodically and connected to the trough by flexible tubing

a month before eggs are needed for hatching. Provided range and ample room to forage is available they can be given a small wet mash or pellet feed in the morning and another of grain at night.

A suitable growers' ration designed to be fed from 3-6 weeks or up to fattening is as follows:

	cwt	lb
Coarsely-ground wheat	2¼	
Finely-ground oats	1	
Finely-ground barley	2½	
Maize	2	
Dried grass	½	
Meat and bone meal	¾	
Decorticated ground-nut meal	1	
*Limestone		14
*Manganese salt		3½

* Or minerals according to the makers' recommendation.

+Vitamin A, D3 and Niacin to supply the following per half ton:

Vitamin A	1,500,000 I.U.
Vitamin D3	150,000 I.U.
Niacin	30,000 Mg.

FATTENING

Fattening starts about three weeks or so before killing. This is a very important phase and everything should be done to see that the ducks put on as much weight as possible in the shortest time. If relatively few birds are being finished they can be divided into numbers of about 60–70, but with large-scale rearing the only real change is that of food. It is inadvisable to give birds access to swimming water. Daily strawing down of houses, if they are used, and the pens will help to keep the ducks clean and it will make them easier and more pleasant to pluck. It is usually 8–9 weeks from hatching to killing and this short period obviously does not allow for mismanagement. To produce a duck weighing 5–6 lb within this time it is essential to have a thorough knowledge of the job.

Where grower's pellets have been used this practice can be continued, or they can be changed to a specially prepared fattening formula. The former is rather an expensive way of finishing, as the protein content is higher than is thought to be necessary. The National Research Council of America have no recommendations for this period, but a good fattening ration should be designed to put on as much flesh as possible. Wet mash fed twice a day, each time giving as much as the ducklings will eat, will soon increase weight, but it is important to remember that overfeeding tends to sicken the birds, so their appetite should always be kept slightly sharp.

A suitable fattening ration is as follows:

	<i>cwt</i>
Maize (white)	3
Barley	3
Wheat	2 $\frac{3}{4}$
Meat and bone meal	1 $\frac{1}{4}$
Minerals	According to the makers' recommendations
+ Vitamins A and D	as for growers

It is not advisable to use fish meal as a protein supplement, as it may taint the flesh; meat meal is preferable. White maize is more suitable than yellow, which might give a slight yellowish tinge to the carcass.

ANTIBIOTICS

The information available on the use of antibiotics in duck nutrition is rather contradictory, and there is no positive evidence to suggest that they have a beneficial effect on growth or feed efficiency.

SUBSTITUTES

Some substitutes are still used, mainly potatoes and so-called Tottenham pudding. Potatoes are undoubtedly very useful as a fattening food, but with the high cost of labour and fuel, it is doubtful whether they are now economic to feed. Four lb will replace 1 lb of mash. Pudding, though rather difficult to handle, is perhaps a better proposition, but its main drawback is that it varies so much in nutritive value according to the time of the year.

Some fatteners think that soaked and steamed grain makes a very satisfactory contribution to finishing. It is prepared for twenty-four hours or so before being used, which certainly makes it palatable and the ducks will eat it readily. Mutton fat was fed on a restricted scale before the war at the

rate of 3 per cent of the diet, but owing to its present cost, its use must necessarily be limited. Whether other fats such as tallows have a place in duck nutrition remains to be seen.

As with chickens and turkeys, there is little difference between the weight of the sexes during the first few weeks. With ducks, the males are usually about $\frac{1}{2}$ lb or so heavier than the female at killing time.

PRODUCTION COSTS

Cost of production figures can be misleading, as naturally they vary from farm to farm, season to season, and even from year to year, but the following tables, originally published by the National Institute of Poultry Husbandry in 1957 will serve as a basis for this assessment.

NATIONAL INSTITUTE OF POULTRY HUSBANDRY

Costs of Production of Table Ducklings, 1957

Solid floor brooding by means of paraffin hovers was used and at 2–3 weeks the ducklings were transferred to a multi-section timber house where they had access to outside strawyards. A home-mixed chick ration, costing £34. 14s. 5d per ton, was fed as wet mash from day-old to marketing. Water was supplied automatically by means of small galvanised troughs fitted with ball valves.

The average number of ducklings per group was 69, but this varied with individual groups from 43–88. Groups 1 and 2 were each reared as single units but the remainder were subdivided to reduce the number per pen and encourage more even growth. The groups on which costs of production were recorded (484 birds), represent slightly less than one-quarter of the total throughput of the plant (2,040).

The value of the day-old ducklings was assessed at 3s. 3d. each for all hatches. Houses were depreciated at 10 per cent per annum and other equipment at 20 per cent. The ducklings from all the costed groups were sold alive at 8–9 weeks of age according to the following prices:

April to June inclusive 2s. 9d. per lb live weight

July to October inclusive 2s. 6d. per lb live weight

The results are set out below in Tables 1–4. All calculations are based on numbers of survivors.

TABLE I
RETURNS, COSTS AND MARGIN PER BIRD

Group	Hatching Date	Original No. of Birds per Group	Age when Marketed (weeks)	Returns	Production Costs	Margin
				s. d.	s. d.	s. d.
1	1/2/57	43	9	20 0 $\frac{3}{4}$	16 3	3 9 $\frac{3}{4}$
2	19/3/57	61	8	18 2 $\frac{1}{2}$	12 9 $\frac{1}{4}$	5 5 $\frac{1}{4}$
3	9/4/57	83	8	19 2	11 10 $\frac{1}{4}$	7 3 $\frac{3}{4}$
4	14/5/57	71	8	17 0	10 8 $\frac{3}{4}$	6 3 $\frac{1}{4}$
5	11/6/57	88	8	15 7 $\frac{1}{2}$	11 11	3 8 $\frac{1}{2}$
6	16/7/57	71	9	17 11 $\frac{3}{4}$	12 0 $\frac{1}{2}$	5 11 $\frac{1}{4}$
7	13/8/57	67	9	16 10 $\frac{3}{4}$	11 2	5 8 $\frac{3}{4}$
Unweighted Averages		69		17 10	12 4	5 6

TABLE 2
RETURNS, COSTS AND MARGIN PER LB LIVE WEIGHT

Group	Returns	Production Costs	Margin
	s. d.	s. d.	s. d.
1	2 9	2 2 ³ / ₄	6 ¹ / ₄
2	2 9	1 11 ¹ / ₄	9 ³ / ₄
3	2 9	1 8 ¹ / ₂	1 0 ¹ / ₂
4	2 6	1 7	11
5	2 6	1 11	7
6	2 6	1 8	10
7	2 6	1 7 ³ / ₄	10 ¹ / ₄
Unweighted Averages	2 7 ¹ / ₄	1 9 ³ / ₄	9 ¹ / ₂

TABLE 3
INDIVIDUAL ITEMS AS A PERCENTAGE OF TOTAL COSTS TO MARKETING AGE

Group	Duckling	Food & Grit	Litter	Fuel	Labour	Depreciation
1	21.0	59.9	7.0	0.6	8.3	3.3
2	28.2	57.0	5.1	0.4	6.6	2.7
3	30.8	53.7	3.6	0.2	7.2	4.4
4	31.2	51.8	3.5	0.3	8.0	5.2
5	34.8	49.9	3.8	0.3	6.6	4.7
6	28.6	53.3	5.4	0.2	7.0	5.5
7	30.9	50.1	4.7	0.3	7.7	6.3
Unweighted Averages	29.4	53.7	4.7	0.3	7.3	4.6

TABLE 4
PERCENTAGE LOSSES, FOOD CONSUMED, AVERAGE MARKETING WEIGHT, FOOD PER LB LIVEWEIGHT ATTAINED AND LABOUR PER BIRD

Group	Losses	Food per Bird	Marketing Weight	Food per lb Live weight Attained	Labour per Bird
	per cent	lb	oz		min.
1	4.7	29.3	116.7	4.0	26.9
2	9.8	21.9	105.9	3.3	16.9
3	10.8	19.2	111.6	2.8	17.2
4	2.8	18.3	108.9	2.7	17.3
5	21.6	20.6	99.9	3.3	15.7
6	5.6	22.2	115.1	3.1	16.9
7	6.0	19.7	108.2	2.9	17.2
Unweighted Averages	8.8	21.6	6 lb 13.5 oz	3.2	18.6

SUMMARY

As observed in previous years, hatches during the first two months of the season showed the poorest food conversion. This is attributed to the colder weather conditions in February and March. Group 5 (June hatched) also showed a relatively poorer conversion rate but this is explained by high mortality (21.6 per cent).

Despite a generally higher mortality than in 1956, (8·8 per cent compared with 5·0 per cent) and in some cases a later marketing age, the average food conversion in 1957 was 0·4 lb per lb live weight better than the previous year. This is attributed to an improvement in the quality of the diet and to the effects of selective breeding. The part played by weather conditions is uncertain.

The general level of profitability shows a marked improvement over previous years. In spite of increasing the estimated value of the "day-old" duckling from an average of 2s. 9d. each in 1956 to 3s. 3d. in 1957, the average net profit improved from 3s. 3d. to 5s. 6d. per bird. There are three reasons for this improvement:

- (a) Better food conversion.
- (b) Increased returns.
- (c) Slightly lower food costs.

The factors affecting (a) have already been discussed. The higher market prices were undoubtedly caused by temporary shortages of ducklings in certain areas as a result of the slaughter of large numbers of growers and breeders through outbreaks of fowl pest and virus hepatitis. The average selling price was 2d. per lb higher than in 1956. The average price per ton of food was 26s. 4d. less than the previous year and this had the effect of reducing total costs per bird by 3d. (slightly less than $\frac{1}{2}$ d. per lb).

In conclusion, it can be stated that the unusually high returns of 1957 are probably the main cause of prosperity in the duckling rearing industry at the present time. Nevertheless, the lowering of costs of production has also played a prominent part, and because it does not depend quite so much on extraneous or uncontrollable influences such as supply and demand it is probably the more important factor of the two. A return as low as 2s. per lb live weight in 1957 would still have enabled a profit of 1s. 3½d. a bird to be realized.

Preparation for Market

KILLING

The stage at which ducks should be killed is governed by three important factors on which the quality and appearance of the carcass will also depend.

The ducks must be in good condition, well finished, and fully feathered.

When the feathers begin to fall from the neck and breast, and the flight feathers are about 3–3½ in. long, it is time to slaughter. This stage is called killing at "first feather". Some fatteners keep their birds to what is termed "second feather". This means that they have already moulted once, and that they will not be killed until they have become fully feathered again which will take 5–6 weeks. This is done to get a larger bird in 14–16 weeks, and the gain in weight is about 25 per cent.

The birds should be starved for 18–24 hours before killing so that the intestines will be empty. The carcasses will keep better as a result, and it also makes the job of eviscerating much easier. Killing can be either by sticking or by dislocation. If the former is preferred, (and it is advisable if

the birds are to be cold-stored) a cut is made into the roof of the mouth by an upward movement; the knife will then penetrate the brain. The jugular vein found at the back of the throat should next be severed. The bird must then be drained before being plucked. For this purpose specially-shaped cones mounted on a circular stand are to be found in most plucking establishments (Fig. 11).

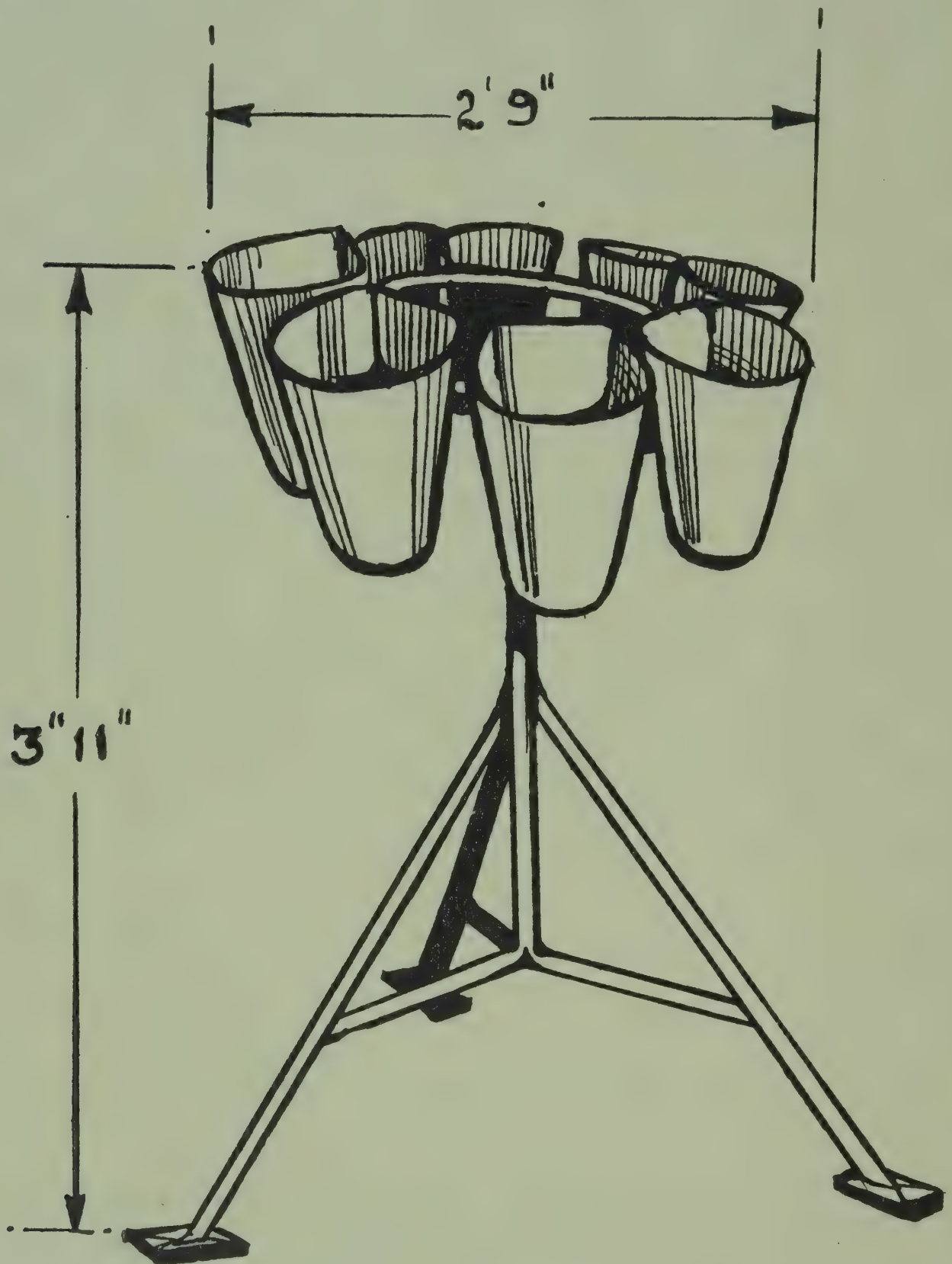


FIG. 11. Draining rack

Dislocation of the neck is a satisfactory method provided that it is done properly. As a duck's neck is rather long, this is not always easy. A broom handle will be found to be most useful if only a small number of ducks are to be killed. It is placed on the floor with the duck's head underneath where the latter joins the neck. The person who is killing stands on the handle astride the bird and if the bird is pulled upwards quickly dislocation soon takes place. It is important that there should be complete severance, otherwise the body will not drain completely. If this happens, there will be a reddish tinge to the flesh which will detract considerably from its appearance when plucked.

PLUCKING

Ducks and geese, are the most tedious of all poultry to pluck, and as the feathers are a valuable by-product, it is practically always done by the dry method. Wet, or wax plucking are much quicker methods, but they are seldom used as the feathers lose most of their value. Plucking by machine is the general standard method, finishing off by hand.

Plucking should start immediately the bird is killed, and to prevent any tearing or barking of the skin, only a small amount of feathers should be removed each time, until some experience has been gained. The tail and large wing feathers should be the first to be taken out and kept separate, then those on the back, legs and around the lower part of the body, and lastly the breast and neck. Leaving the breast and neck until later will prevent a reddish appearance that sometimes occurs if the blood has not completely drained from the skin. The stubbs, on the other hand, are best removed when the carcass has slightly cooled off, as they will come out easier and there is less likelihood of pieces of fat coming away with them.

A good, experienced hand plucker will pluck about eight birds an hour, which should keep two stubbers busy.

The down that clings to the flesh is difficult to remove, but satisfactory results can be obtained by singeing. The best method is to put a small quantity of methylated spirits into a flat vessel and ignite it. This will then burn with a clear flame and if the duck is passed through it, no charring occurs. Using lighted matches or tapers, tends to blacken the surface of the skin.

If there are many carcasses, removal of the feathers by using hot wax is a more practical approach, and interesting information has been published by the National Institute of Poultry Husbandry on this work. The birds were rough-plucked by machine and some by hand. They were cooled for approximately 15 minutes before immersion in paraffin wax at a temperature of 140°F. Dipping just once was found to be adequate. They were then immersed in cold water for another 15 minutes to solidify the wax. This was pulled off at first by hand, but, it was found that a rubber-fingered plucker did it in less than a minute per bird. The carcass was found to be perfectly clean and quite free from hair and down. The wax undoubtedly gives a very good opaque finish and about 40 per cent of it can be reclaimed for further use.

Processing Losses

Details of loss of weight during processing are given in Appendix IV on page 92.

COOLING

As soon as plucking is finished, the wings should be folded back and the legs and bill scrubbed to remove all dirt. This is seldom done, but the improved appearance makes it well worth while. The legs are then twisted back so that the inside of the web of the foot is against the bird's back. Any faeces that are found in the vent must be squeezed out. The ducks should then be cooled to a temperature of 32°F as it is necessary to get rid of the body heat as soon as possible. Specially-designed cooling racks are used for holding them (Fig. 12). These racks are sometimes on wheels for convenient

movement from place to place. Where cold rooms are used, the racks are just wheeled in, thus dispensing with unnecessary handling. If only a small number of birds are plucked they can be laid flat on their breasts with a weighted board over their backs. This will press them down, the idea being to give them a broad breast which adds to their appearance. Large cooling rooms are found on the farms of the big fatteners and the ducks are put into them after the day's plucking. It is essential for the birds to be cold before packing starts, otherwise they may turn green in hot weather.

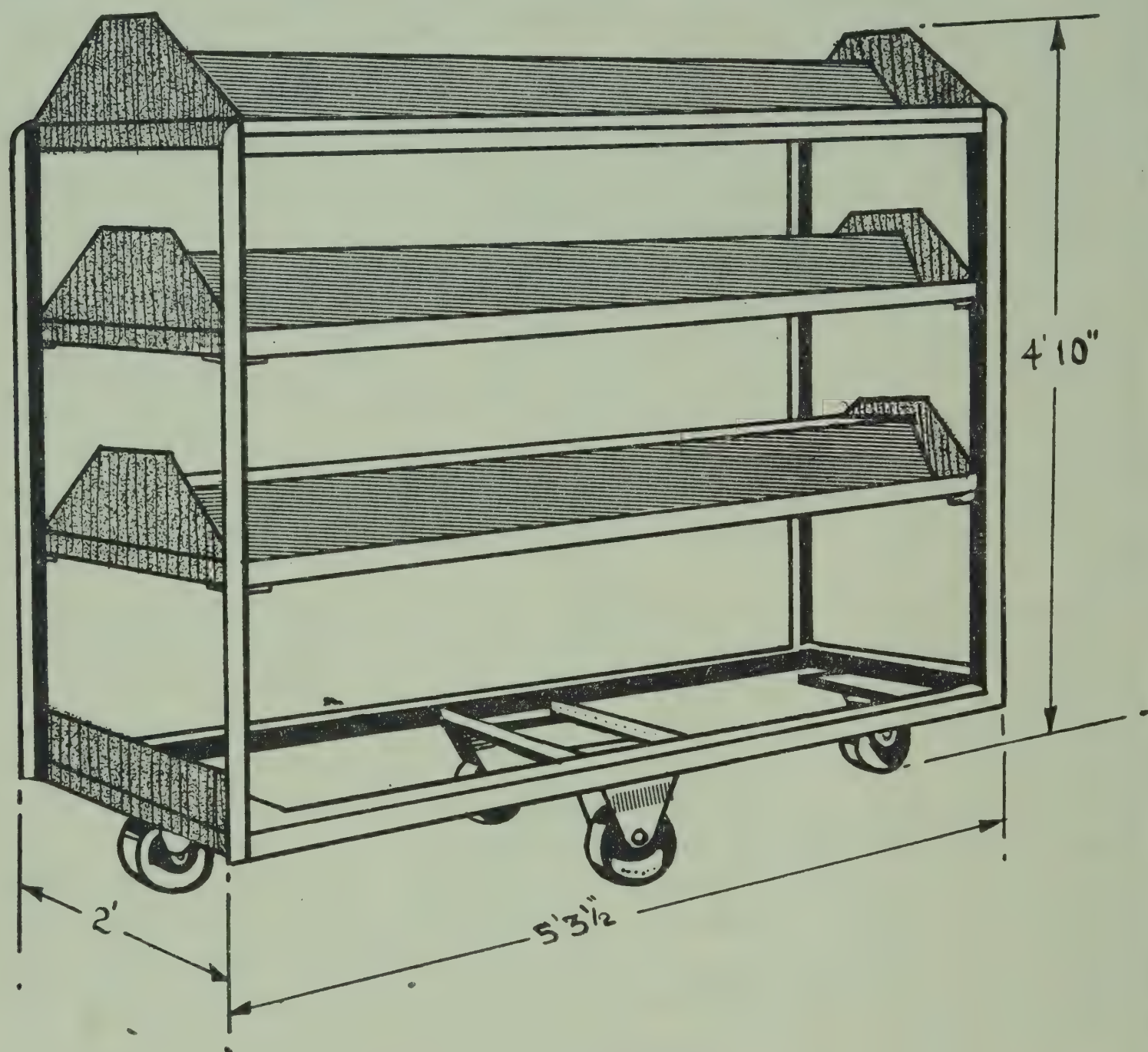


FIG. 12. Cooling rack

PACKING

Until recent years, few producers have taken much interest in packing and presentation. The ducks were usually placed in boxes lined with greaseproof paper and sent to market. As with other table poultry, this side of the business has made rapid progress, and packs are now being sold in the most attractive manner. The ducklings enclosed in transparent wrappings are generally put in containers made of wood or stiff cardboard with not more than six birds per pack. For six ducks weighing 6 lb and over, the inside measurements of the box should be 35 in. $\times$ 12 $\frac{3}{4}$ in. $\times$ 4 $\frac{3}{4}$ in., and for 5–6 lb, 33 in. $\times$ 11 $\frac{3}{4}$ in. $\times$ 4 $\frac{1}{4}$ in. The cost of boxing in wood works out about 1 $\frac{1}{2}$ d.–1 $\frac{3}{4}$ d. per lb. In order to get them as uniform as possible, the ducks should be graded for quality and size. Second-quality birds should be disposed of separately and not boxed with those of first grade.

Making an article look attractive goes a long way to selling it, and potential purchasers will naturally favour one that draws immediate attention. Large establishments, usually packing-stations and some progressive farmers too, sell their products under a branded name, marking on the box the weight, grade and name of the packer or producer. These conveniently-sized packs are easier to handle and store, and not much more effort is needed to handle a hundred boxes than a hundred individual birds.

Quick freezing has also become a feature of the table-duck trade, and many hotels, restaurants and housewives find frozen oven-ready birds most suitable for their needs.

MARKETING

Ducks are not usually marketed alive except for the Kosher trade, as they do not travel well, and they tend to lose too much weight in transit. However large or small a consignment, arrangements for marketing should be made well in advance, and much more satisfactory results will be achieved by good organization in this direction.

There are various demands for ducklings, e.g., through packing stations, wholesalers, dealers and retailers, but the duck trade is unlike that of other table poultry, being much more specialized and its distribution not nearly so wide. It is confined largely to the catering trade. Housewives in search of poultry seldom purchase a duck, possibly because it is not such an economic proposition.

A limited number find their way to the packing-stations where they are normally eviscerated and sold fresh or frozen. Some are disposed of through dealers but these birds travel badly and lose weight. The bulk is sold through the wholesale trade mainly in London and the large industrial areas of the Midlands and the North. The ducks are usually plucked, wrapped and boxed.

Retailers, and this means to a large extent butchers and poulterers, seldom seem to have ducks for sale. This may of course be due to the fact that they cannot get supplies, and it does seem that they are just not available outside London and some industrial cities. The industry would greatly benefit if the interest of the housewife were aroused, for in this direction lies a potential market that, to a largest extent, has been neglected in the past.

Egg-Laying Varieties

REARING

When rearing ducklings of laying breeds as future layers or breeders, the aim is even growth with rapid maturity and hardiness to withstand the strain of high egg production. Checks in growth must be avoided if ducklings are to be reared economically.

Ducklings produced to replace one's own laying flocks are usually hatched in April or early May, but to meet a demand for laying-stock replacements and to obtain the maximum number of ducklings from special parents it is necessary to prolong the season both before and after.

COLD AND WET CAN BE FATAL TO DUCKLINGS

Naturally, with a season which extends through various climatic changes, rearing methods have to be adjusted to suit differing outside conditions. In the very early months of the year it would be fatal to deprive the ducklings of heat and then immediately turn them out into a wintry temperature. They would be far better off if left indoors up to five weeks old. On the other hand, if the weather is warm and fine they benefit from the sunshine and good-quality, short grass range.

Rearers often forget that artificially hatched ducklings chill as easily as chickens. If ducklings get on to water or are caught in a heavy downpour of rain before they are partially feathered, their down gets sodden and, except in very warm weather, they quickly chill. This is because they have not had the oil imparted to their down by a mother duck before leaving the nest, as is the case with all wild waterfowl under natural conditions. If they had this oil their down would be completely waterproof and they could safely swim from the time they left the nest.

Feathers start growing on the thighs and shanks and quickly follow on the undercarriage. Ducklings should not be allowed to paddle or be left out in heavy rain until these feathers have grown, nor can they withstand wintry weather for an indefinite period until fully feathered.

Unfortunately ducklings instinctively make for water and, during a heavy shower, instead of running for shelter, will hunch up and face the storm unless they know that a source of heat is available. Young ducklings should therefore be either permanently housed or, if in open pens, the attendant should be prepared to drive them to the shelter of a house where they can be shut in during a storm.

HOUSING

Hay-box Rearers

Where very small units of ducklings are run together, hay-box rearers, as used for chickens, are quite a satisfactory form of housing and penning. Those that take 40 chicks up to 8 weeks are suitable for about 20 ducklings up to 4 or 5 weeks. The hay-box rearer is a low 3 ft $\times$ 3 ft ark to which is attached a 6 ft-long run with boarded sides and wire netting top. The ark has a $\frac{1}{2}$ -in. sq. mesh floor and hard-board circle to cut off corners, the corners being filled with hay. Resting on the circle is a square frame covered with hessian. Two bags packed loosely with hay to a thickness of approximately 4 in. should be placed on top of this to make a ceiling and surround which conserves the body heat of the youngsters inside. These fittings can be removed as the ducklings grow and become hardier.

The ducklings know that their sleeping compartment (the ark) is a source of heat, and when they feel the need of it they will go inside — an advantage when they begin to feel cold after being caught in rain. After a day or so in the rearer there is no need to shut the pop-hole as the ducklings will find their own way in and out. Hay-box rearers are safe to use in any weather; they can be moved to fresh ground daily and no cleaning out or renewal of litter is required.

Apex Arks

If one or two hatches are raised in a season, an alternative and quite good method is to use apex arks with plenty of head room and with 1 in. mesh

wire floors on 3 in. $\times$ 2 in. skids in a grass pen. These can be moved to fresh ground by one person and, because of the wire-mesh floors, do not require litter or cleaning out. Small lean-to type houses in a grass pen are also suitable.

The Colony Brooder House

For the duckling rearer raising anything from a few hundred ducklings upwards a year during different seasons, a colony-type house with low partitions, each compartment taking ducklings of similar age, is as good as any. The youngest ducklings can be put in a compartment at one end of the house and moved to larger compartments as they grow, and younger ducklings are produced to take their place. Partitions can run the full width of the house or, on a larger scale, can be divided by a service gangway down the centre.

Space Requirements

Under good conditions ducklings grow quickly. To do so normally they must have plenty of room to exercise. The following is suggested as the floor space requirements of intensively-reared ducklings run in batches of forty:

<i>Age (weeks)</i>	<i>Sq. ft per duckling</i>
1-2	1
2-3	1½
3-4	2
4-5	2½

With batches of different numbers the measurements could be altered greatly, e.g., the recommended requirements for an American farm where ducklings are raised in groups of 1,000 are:

<i>Age (weeks)</i>	<i>Sq. ft per duckling</i>
1-2	½
2-3	¾
3-4	1
4-5	1¼

Overcrowding results in uneven growth, ducklings with small bodies and with head and bill large in proportion, roached-(humped-) backed and bow-legged.

The house should be well lit and ventilated to allow plenty of fresh air without draughts. A wooden floor is warm, easily cleaned off between batches of ducklings and a protection against rats.

Litter

Coarse pine sawdust or shavings and chips is a particularly useful and healthy form of litter. This should be laid to a depth of about six inches, then raked over and added to as required and changed when each batch of ducklings is moved to another compartment. If sawdust is not available coarse peat moss or sand can be used. If the house has no floor but is laid directly on to the earth the site should be really dry and the earth forked over frequently. To prevent rats or mice entering, ¾-in. mesh wire netting should be buried vertically 18 in. deep around the walls.

In a colony brooder house in which many ducklings are run, the chief requirements are plenty of windows — which can be taken out in fine weather to give direct sunlight — and ample height and good ventilation to allow for plenty of fresh air.

Management

The brooder house could be arranged so that, as the older ducklings are due for a move to a grass pen they could be driven direct from the house. When ducklings start to feather they do not like being handled and are more nervous at this stage than when covered with down or with feathers. This is because it hurts to touch the young, growing feathers. Handling of growing ducklings should therefore be avoided as much as possible and ducklings should be driven slowly whenever feasible. Ducklings or ducks do not like to be rushed and moves should be done slowly and not over long distances.

The weather for each season varies considerably, but if ducklings are to be reared continuously over a long period the ideal lay-out after the hot brooder stage is considered to be the colony house previously described, five grass pens (one for each different age group) and one pen, much larger, adjoining. Each one of the five pens is used to take a batch of ducklings from the brooder house and then these are moved to the next pen and so on. When these are all full the oldest ducklings are let out into the larger pen to mix with older ducklings and, as those let out are approximately nine weeks old, and well grown, they mix well with the older birds if they have sufficient space. If required, they can be let out on to range and driven to a pen for protection at night.

The first two of the five pens should each have a fixed shelter; for the others, natural shelter and shade would suffice. The whole should be enclosed in 6 ft of wire netting with the bottom selvedge buried 1 ft deep to prevent vermin entering.

FEEDING

Baby Chick meal mixed to a crumbly mash or Baby Chick Crumbs, granules or pellets should be fed until the ducklings are let out on to grass. If mash is used they should be fed three times daily — as early as possible in the morning, one hour before sunset and the other feed mid-way between. The ducklings should be fed at exactly the same times each day. If pellets or granules are fed *ad lib.* the ducklings will always have sufficient but will never overfeed. The feed is placed in hoppers which hold sufficient food for several days and from which the ducklings help themselves.

Plenty of trough space is essential for even growth, especially where feeding is not *ad lib.* and the ducklings all feed at the same time. It is far better to have too much trough space than not enough. Troughs should be placed in a straight line if more than one is used for a batch of ducklings. Ducklings then quickly find a space at which to feed, whereas if several troughs are scattered they will crowd to one trough after another until they have finally found room. Troughs placed in a line are also quicker to fill from end to end and crowding to the first trough to be filled is avoided.

After the first few feeds on a biscuit tin lid or something similar, quite a useful trough can be made out of a 6-ft length of galvanized guttering. The ends should be covered with two squares out of a piece of board. A further piece of board is nailed at a right angle to one side of each. This gives two L-shaped pieces of timber which should be placed on the floor so that the bottom part of each "L" faces the other. The guttering is then nailed to these through the holes at each end (already in the guttering) so that the upright parts of the L close the open ends of the trough to avoid food spilling.

As ducklings grow they can be given deeper troughs to hold more food. Galvanized-iron pig troughs are quite suitable and a cheaply constructed trough for wet mash can be made from galvanized ridging cut to 3-ft lengths. At each end of these, a square of wood is needed with a "V" shaped from 1 in. $\times$ 1 in. timber nailed flat on to it. The end of the ridging rests against the square and inside the V, and is nailed securely to the V-strips.

If the ducklings are fed on Baby Chick crumbs or pellets *ad lib.*, suitable hoppers can be purchased for indoor or outdoor use.

Water Supply

Drinking water should always be available for ducklings, but the containers should be constructed so that ducklings cannot paddle in them. Top-filling founts used for chickens at various stages are also suitable for ducklings — the one-gallon size for ducklings up to a fortnight, and a larger size beyond this age. There are several suitable automatic waterers on the market, but before buying it is advisable to enquire whether it is suitable for ducklings because some that are correct for chickens may become clogged with food when used for ducklings. Ducklings strain their food before swallowing it using the rough outer edges of the bill to do so.

To encourage them to exercise during the growing stage ducklings should have their food and water containers placed well apart. As they eat some food and then strain this in the drinking water before eating more they are constantly on the move whilst feeding.

Separate containers holding coarse, washed sand to aid digestion should always be available.

When the ducklings are moved to grass pens they can then go on to a less concentrated food — growers' mash or pellets, mash to be fed three times daily, pellets *ad lib.* or controlled to three feeds. Limestone grit or shell grit should now be available in separate containers.

If the ducklings have left the unheated brooder house at an early age (about three weeks), the larger size top-filling founts will be suitable for a further two weeks. After this larger water containers can be used so that the ducklings can get into them to bathe. Shallow concrete pools or channels or specially-made metal duckling baths can be used. These should have gently sloping sides so that the ducklings can easily wade out. They need be only a few inches deep.

When flight feathers are just starting to grow it is advisable to supply water in such containers and to allow plenty of trough space for feeding, since it seems that the lack of wing exercise such as splashing in water and also lack of trough space and resultant jostling both lead to what is commonly called "slipped" or "rough" wing. This term is applied if when one or both wings are folded back to the body the flight feathers are misplaced and stick out at an angle to the remainder of the wing (see p. 86).

When the ducklings are about six weeks old, a mixture of kibbled maize and wheat can be fed as well as the growers' balanced ration. This should replace the evening feed of growers mash or pellets as it stays in the crop longer and so keeps the duckling content throughout the night. Like all other changes which have to be made in a duck's diet, the transition should be gradual. If a different food is used suddenly the ducklings (or ducks) will eye it with suspicion and be slow to eat it readily. When changing feedingstuffs it is advisable for the first two or three feeds to mix some of the new type of

food with that to which they are used. When ducklings are 8–9 weeks old their feeds can be reduced to two: morning and evening.

CULLING

Any unthrifty ducklings, and any with deformities, should be culled as soon as noticed. If a standard has been set for colour and the rearer does not wish to retain or sell colour-defective birds, or alternatively if he wishes to earmark specially good birds for colour for future stock, it is advisable to know how to select at a very early age: e.g., yellow down on the throat or yellow beneath the base of the bill in coloured breeds develops into white feathers.

Before the male ducklings of coloured breeds get their adult plumage they have a first plumage similar to that of the female of the same age. By turning up the thigh feathers and examining the feathers which are just beginning to grow on the thighs it is possible to get a good idea of what the adult body colouring is going to be like.

In the Buff Orpington the first plumage is often misleading. A duckling with very pale buff feathering often turns out to be a deep-reddish buff that is the most popular shade, and ducklings of deeper colouring turn out to be too light in colour as adults. Similarly, males in first plumage might be rejected because they show signs of having grey heads and necks which is contradictory to standards laid down for the breed, but later on the grey often turns to the required seal brown.

Whereas Khaki Campbells having white throat feathers (“bibs”) are more likely to reproduce these than not, Black Cayugas with white feathers often produce the best show birds.

MANAGEMENT OF ADULT STOCK

Breeding stock should be mated up at least a month before fertile eggs are required. The usual mating for a single male pen is not more than seven females in laying breeds. This is where the ducks are penned together and the male remains with them throughout the breeding season.

Although when ducks are mated up very early in the year, males may not be quite so active as later in the season because of wintry conditions, it is still advisable to use the same proportion in flock matings. As the season advances and drakes become more active, if it appears that a percentage of the ducks are getting too much attention from the males, it is wise to remove say one drake in a flock of forty ducks to ensure that the ducks are not over-mated and to save feeding costs.

When breeding ducks are penned separately and the drake is moved systematically from one duck to another daily, one drake will cover ten ducks and should be mated to each duck every tenth day.

Drakes will only mate with ducks from about a month before they come into lay and throughout their laying period.

In this country it is generally considered that 40–50 laying or breeding ducks to a flock, is the maximum to run for high production and that small pens of 10 ducks give even better results. The most economical number of birds to run to a pen depends upon factors other than egg production, i.e., labour available, labour costs, cost of penning material, market value of duck eggs, etc. If ducks are run in pens of 10, an increased number of food

and grit troughs, stakes for penning, increased water trough capacity and wire netting will be required, whereas with flocks of 40–50 birds these items are reduced. Labour also needs to be of the best to carry out feeding, egg collecting, re-littering, etc., economically.

PENNING

Penning methods depend as much upon conditions at a given time as upon the variation in egg production from pens of different numbers. In America, where labour costs at present are three or four times higher than in this country, flocks of 200 birds and more are run together, feeding them from hoppers which hold anything up to $1\frac{1}{2}$ tons of food and which are refilled direct from feedingstuff manufacturers' bulk delivery lorries to cut out the expense of handling by employees. In Holland, where many thousands of Khaki Campbells are kept on each farm, ducks are run 10 to a pen and are fed by hand twice daily.

As far as egg production only is concerned, small pens definitely give the best results, and the person who should be able to obtain these most economically is the domestic duck-keeper who runs only very few birds.

Ducks are sensitive creatures, easily excited. If kept in small numbers the danger of any excitement spreading is reduced. If larger flocks are run together, pen conditions must be such that the birds can lead a completely quiet and peaceful life.

It is difficult to lay down any hard-and-fast rule for duck pen dimensions — much depends upon the type of ground and food used. Ducks will eat a large amount of animal protein in the form of worms, slugs, etc. After a couple of years in the same small pen all insect life will have been eaten up, and unless a very high protein food is fed, egg production will drop.

A pen should be sufficiently large and well sited to ensure that the birds have a certain amount of good grass and not just muddy ground. Ducks should not be confined to marshy ground which, in time, will develop into a quagmire, because they will get out of condition and in all probability will suffer from infected eyes and nostrils. However, provided that they can get on to dry ground some of the time, there is no objection to ducks having access to marshy ground if on free range, or in a pen, since they will find a lot of natural food, enjoy themselves, and do much towards improving it. For a permanent breeding pen on reasonably good ground 20 sq. yd per bird is sufficient.

In the Dutch system ducks are kept in rows of very small narrow pens (e.g., 18 ft $\times$ 6 ft), 10 breeders or layers to each pen. For this system the ground has to be well drained, preferably on sloping sandy soil. A long house or shelter runs the entire length, (at the top) of the pens, and running water is supplied by means of a concrete channel at the foot of the pens. Where single duck pens are used the width of the pen is reduced to about 18 in. The whole is enclosed by high wire netting as a protection against predators, and birds do not have to be driven into their house at night and let out in the morning.

Where it is economical to keep birds in small units there is much to be said for this system. Where trap nesting is carried out, one male is handled daily instead of every female in a pen. One male can be mated up to ten females, providing a greater number of his progeny for testing, and feeding costs are cut by the reduced number of males used. Also with small units

more careful observation is possible, and progeny from each female can more easily be kept separate.

FREE RANGE

Where it is possible to disperse flocks, or when only one flock is kept, the free range system has its advantages, in that a certain amount of feedingstuffs expenditure is saved and penning expenses are eliminated. The system is especially suitable on a general farm, where the farmer does not wish to add to his labour by feeding separate pens, or if he has marshy ground unsuitable for other stock. The birds will forage for a large proportion of their diet and will also clear ground of the slugs responsible for liver fluke in cattle.

GENERAL REQUIREMENTS

Although it is correct to say that ducks will live entirely in the open without any form of housing, the layers and breeders should be adequately housed if eggs are required through the winter months. Ducks need protection from keen winds and will lay better if they have a dry bed on which to sleep. Since ducks lay 98 per cent of their eggs during the night and before 9 a.m. in the morning, their eggs would either be lost or taken by birds if they were not housed.

Housing need not be elaborate, but the birds appreciate comfort. Too often ducks are housed in cramped, improperly ventilated or draughty houses with leaking roofs and walls. It is a common fallacy to suppose that, as ducks do not perch, they require little head room. Early moults and broodiness are often the result of low roofs and stuffy quarters in the summer.

Although they do not like biting wind, sleet or snow, ducks do not mind the cold. However, if they are housed at night in a stuffy atmosphere, it is noticeable that immediately they are let out in very frosty weather they "flop out" very temporarily on leaving their sheds, whereas birds in roomy, well-ventilated houses are not so affected.

A pen of one drake and seven ducks needs only a small lean-to type house, say 6 ft $\times$ 4 ft, 3 ft high at the back and 4 ft high in front. Four sq. ft of floor space per bird should be allowed for a flock of 50 or more birds. With the increased heat from this number of ducks greater wall height is essential to ensure that hot and damp air can rise above the level of the birds. If a lean-to type (the most economically and easily built) the back wall should be at least 5 ft high and the front wall at least 9 ft. Ventilation must be sufficient to prevent wet walls and litter and to supply constant fresh air.

As the ducks have to remain in until 9 a.m., windows should be provided so that their eggs may be easily seen when collected. When birds are kept in a large flock they will be happier and do better if they are fed and watered before being let out.

Ducks houses should be placed on a dry site and windows and doors should not face the prevailing wind. When erecting a house points to remember are:

Rainwater from the roof should be caught in a gutter and a drain or stone-filled ditch should run around the house to carry off this water (if not collected) and any seepage from adjoining land;

The door of the house should be fairly wide (3 ft would be suitable) as the ducks will be anxious to leave in a hurry upon being let out and all try to do so at the same time;

The site for the house floor and entrance should be as dry as possible — preferably on a slope, because the ground at the entrance and just in front of the house is likely to become muddy with constant traffic of ducks;

A natural earth floor with a good deep layer of sand or ashes is as good as any. Concrete is cold and to avoid egg breakages a good depth of litter is needed. A mixture of cement and sawdust is warmer. A boarded floor, although warm, is not particularly satisfactory because of the continual dampness from the ducks' droppings.

Nest Boxes

Nest boxes should be provided for laying ducks at the rate of one nest to every three ducks. A simple form of nest can easily be constructed by making partitions 12 in. $\times$ 14 in. held apart by a 6 in. board running along, but not fixed to, the back wall of the house. The partitions should be nailed to this board at 11 in. centres and the whole made rigid by nailing a board, 2 in. wide, along the front at ground level, the top and front of the nests being left open. The range of nests are thus portable and can be removed for cleaning.

Trap Nests

Trap nests can be made quite easily by constructing cages of 1 in. wire netting stapled to batten frames. The two sides with ends and divisions between are fastened together with tying wire. A hinged lid of the same material should cover the range of nests. After the breeding season they can be dismantled, cleaned and stacked flat for storing. The range of nests can be any number — in useful units of from 1–6. These are not trap nests in the true sense of the words — in a proper trap nest the entrance is in the front, in the form of a door which can be set in a raised position by means of a catch which is released by the duck as she enters. The door then drops behind the duck to “trap” her in the nest.

Using the wire-cage type advocated it is a simple matter to lift ducks into the nests at night and release them again in the morning. There is no danger of two ducks at a time entering the nest or of catches being sprung before entry, and it ensures that all eggs are recorded.

By penning ducks separately at night full records can be kept of every individual breeding duck and families built up from individual birds. This is made possible only by marking the adults, the eggs they lay and their offspring, immediately they hatch, so that they can be traced throughout their life, their sires and grandsires traced, and a family record or pedigree kept.

Trap-nest Recording

Adult stock carry leg bands or wing bands upon which are indented a number and the year in which they were hatched. At night each duck is confined to its own nest (apart from one duck which may be left loose in the house with the drake). In the morning the birds are released and the band number of any duck which has laid is written on its egg. After collection the egg is recorded in a Daily Egg Register and then stored, together with other eggs laid by the same duck, until set for incubation.

On the Hatch Record of the incubator chart the leg or wing band number of the duck is written under “Dam’s number” and the number of eggs set under the appropriate heading. On the 24th day eggs from this

6568 6565
19.1.66

duck are placed together in muslin bags (tied at the top and allowing plenty of room for ducklings to hatch) or else in proper pedigree trays. When the hatch is complete ducklings are removed from their bags or trays and "toe slit", all ducklings from the same duck carrying the same toe slit mark. All breeding dams should each have been allotted a pre-arranged toe slit mark for all their offspring bred throughout the season.

Marking Methods

These toe slits, which need only be $\frac{1}{16}$ in. long and are straight cuts with a very sharp knife or razor blade, last throughout the duck's life.

If the duck breeder happens to be a member of a Club — club rings are available for various breeds. These are aluminium closed rings which have to be fitted on to the duckling's leg over the foot at 4–6 weeks of age. The bird's leg grows up inside the ring and any particular bird is traceable to the person who bred it. If closed rings are not used adjustable leg bands can be used when the birds are nearing maturity. Wingbands are fitted at day old. When these wingbands or leg bands are fitted the duck (or drake) bears its own identity number and becomes a potential "individual" breeder — prior to this its only identity was its toe slit which was not an individual mark but merely identified it as having been bred from its parents.

The ring (wing or leg band) number is marked down in a pedigree book, so that by looking up records one can at any time trace individuals, their parents, brothers and sisters, sons and daughters and so on, and glean useful information about their whole family — egg production, average weight of egg, hatchability, type, colour or any items of interest.

FEEDING

The nutritional values of various foods are dealt with fully in Bulletin No. 174, *Poultry Nutrition*,* and should the breeder wish to mix his own feedingstuffs, the correct proportions for a balanced diet can be calculated from the information given in this bulletin. If the breeder wishes to mix his own food suitable grain can be milled and a supplementary concentrate mixed with the ground grain.

Meal derived from such a mixing can be formulated for all stages of growth, or "Baby-Chick", "Rearers," "Growers," "Layers," and "Breeders" meal or pellets can be purchased ready balanced. Although the ducks will eat meal dry, it is best mixed with water to a "crumbly" moist mash.

If birds are to be fed *ad lib.*, pellets should be fed rather than a wet mash, as the latter becomes stale and sour if left lying about.

The advantages of pellet feeding are that they are ready for consumption; if *ad lib.* feeding is required to cut down labour or to stagger work, the pellets can be fed in hoppers and if a grain feed is given as well, several day's supply can be provided by the grain and pellets in alternate layers.

However, home-grown milled and mixed rations can be used in wet mash feed which will cost less than proprietary foods.

If penned ducks have 20 sq. ft each or are on free range, two feeds per day is sufficient; if they are in smaller pens an additional midday feed is beneficial. As they are confined until about 9 a.m. it is advisable to feed

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ducks in larger flocks before they are let out — say at 7 a.m. — either by opening up hoppers or by giving a feed of wet mash in troughs. If they are not fed before being released they instinctively start foraging, and leave their feed, or hurry over it.

If mash is used for the morning feed a grain feed can be given in the evening. This should be 50 per cent kibbled maize and 50 per cent wheat and should be fed about one hour before sunset.

Food consumption is never static since it varies with the weather and circumstances; for example ducks will require more food during cold weather, less when it is warm and wet, more when in heavy production, and less when not laying. A duck in full lay kept in a small run will eat 6–7 oz a day, but with good pasture to range over this can be reduced to 3–4 oz.

As already mentioned, ducks will consume large quantities of animal protein and a particularly useful supplement to the diet is fish scraps, pressure-steamed so that bones, etc., are edible. Fed fresh it does not flavour eggs or meat; if not fresh the ducks will not eat it and it would be most objectionable to use.

By using fish scraps, which can form up to 50 per cent of a laying duck's diet, total food consumption can also be reduced. If such food is obtainable free or cheaply, the duck is without doubt, the most economical of fowl to keep, apart from the goose. A laying duck can be fed on a diet of 50 per cent cooked fish scraps, 50 per cent mixed maize and wheat, but such a high protein content for the breeding duck is not recommended.

Limestone grit, shell grit or mortar rubble to form egg shell, and a hard coarse grit to break down food in the gizzard, should always be available and fed in separate containers. A little limestone flour can be added to the food occasionally during heavy production, but care should be taken in using it, since ill effects could result from too large an intake.

EFFECTS OF ENVIRONMENT

Correct management is simplicity itself and an egg per bird per day will be the reward, although naturally the number of eggs which a duck will lay varies not only with the breed but more particularly with the strain. The approximate annual egg production of the main breeds is given in Appendix V. Besides management, environment also plays its part. A well-bred but badly housed duck will lay few eggs and will be less profitable than a contented, well housed one of inferior quality.

Duck flocks always have one or two nervous ducks amongst them. If frightened by predators or the sudden appearance of strangers, bright lights, or shadows at night, they will transmit this nervousness to others. The breeder should therefore try to place houses and pens to avoid such interruptions to a quiet life, and also try to tame the birds as much as possible.

Fish scraps or similar extra animal protein in the diet has the effect of making the birds less nervous. If birds are not fed *ad lib.*, they should be fed at exactly the same time each day to keep them content. Spells without drinking water also seem to make them nervous.

Swimming water is not a necessity for the adult duck. During the cold early months breeding and laying stock are better off without it because loss of body heat swimming in cold water can impair fertility and hatchability. During the hot weather of July and August the birds will enjoy a swim, and at that time of year it helps to keep them fit; but provided that they have

clean drinking water *ad lib.*, they can very well do without swimming. Drinking water should be deep enough for them to be able to get their heads well down into it as they like to be able to throw the water back over their bodies and preen and clean themselves afterwards. If running water is not available but is supplied in a container or pool this should not be allowed to become stagnant.

WHAT AFFECTS EGG PRODUCTION?

One of the factors affecting high egg production is early maturity. Laying breeds should commence laying at about 4-4½ months. The duck which takes seven months to come into lay is unlikely to be a good layer. Another factor is continuous laying without pause, e.g., the duck which lays, then misses a couple of days and so on, at the commencement of laying, is not going to be a thrifty bird to keep. But one that lays for several consecutive days, only missing one day before laying another good run of eggs, is likely to finish up the season with a high score. A Khaki Campbell is known to have laid 10 hard-shelled eggs in 7 consecutive days; 119 eggs in 123 winter days (during the very severe winter of 1947) and finally 295 eggs in 365 days.

SELECTING GOOD LAYERS FOR THE NEXT SEASON

Records of up to 306 eggs in 336 days have been obtained at official laying trials, and farm averages of well over 300 eggs per year have been achieved on farms where flocks run into thousands. Unlike hens, laying ducks can be kept for two seasons' laying without depreciation in egg production, and a few hints are given below on selecting birds towards the end of the laying season which should prove profitable to keep for a further season.

In white breeds the good layer will have lost much of the yellow pigmentation from legs and bill.

In a flock, an idea of the bird's laying propensities can be obtained by noting the condition of feathers and stage of moult; unsuitable birds moult earlier than the average of the flock. If flight feathers have moulted and new flights are almost fully-grown, the bird has been out-of-lay for several weeks.

After heavy production, the body feathers of a good layer will be rough and brittle. In a coloured breed body colouring will have faded very much. (Food has been converted to eggs rather than to feather condition and pigmentation.)

MARKETING DUCK EGGS

A duck's egg is good food and therefore should be handled with the same careful attention to hygiene as, for instance, foodstuffs purchased in a café or store. They should be made to look as attractive as possible and marketed correctly.

Nest boxes should be re-littered frequently with good, clean straw to ensure that eggs are as clean as possible. Each day, as soon as the birds have been let out, the eggs should be collected into a clean receptacle that can be washed easily and disinfected periodically, such as a wire egg-collecting basket or a clean bucket lined with clean hay or straw. If possible, dirty eggs should be kept separate.

Cleaning

The eggs should be taken immediately to a cool room and those that require any cleaning, washed as soon as possible. Eggs for culinary purposes should be washed in warm water of higher temperature than the egg (about 160°F) to avoid contraction of the egg contents and an inwards pull which causes deterioration and the entry of germs.

The eggs should first be placed in wire egg baskets and thoroughly soaked with hot water from a tap or hose. Each basket of eggs is then placed in a galvanized tank containing hot water of the required temperature and a cleaner-sanitizer. The basket is agitated up and down for half a minute or so, removed, and the eggs thoroughly rinsed with hot water. Washing water in the tank should be changed frequently, after two or three baskets have been immersed.

The eggs are then allowed to drain in their basket and when completely dry are packed in clean egg fillers or in cartons if for small retail orders.

If eggs are destined for a packing station they will be efficiently candled there, but it is worthwhile candling eggs going direct to the consumer.

STORAGE, DISPLAY AND PACKING

If the breeder is trying to build up a retail trade it is also worthwhile marketing eggs in attractive cartons holding half-a-dozen or one-dozen eggs, branded with the producer's name and address. Eggs should be placed in cartons or fillers with the air space uppermost, otherwise the weight of the yolk and albumen will tend to displace it.

Quick disposal of eggs means a fresher product and, especially in the warmer weather, the quicker eggs are marketed the better. They should never be on hand for more than a week and, if possible, should be marketed twice weekly.

If eggs cannot be disposed of daily they should be kept in a cool, clean place under similar conditions to those required for eggs being stored for incubation (see p. 17).

When selling privately an attractive display helps to increase sales. Just as the eggs most likely to get the highest awards at a show are the most even, so the "selected" and matched eggs in a carton are most likely to draw and keep customers. Eggs of green or blue tints and white eggs should be packed separately, or attractively mixed if a customer prefers them this way.

If eggs are going on a long journey before they are to be consumed (or going for incubation) they are best wrapped in non-porous greaseproof paper. This helps to retard evaporation. When duck eggs are marketed, a customer can quite easily judge from an external examination of the air space whether an egg is not perhaps as fresh as it might be, or if storage conditions could have been improved upon. Sometimes rough handling in transit will result in misshapen and enlarged air spaces and what appears to be watery whites.

Eggs from laying breeds such as Campbells, Runners, etc., are more suitable for marketing as table eggs than those of the heavy or heavy cross-breeds. A large egg, even though it contains more food value by reason of its size, is not the best egg as regards internal or keeping qualities. Furthermore, these are more profitably used for the production of table ducklings.

GEESE

Breeds and Breeding Methods

WITHIN living memory the number and type of breeds of fowls, ducks and turkeys have increased in number and altered very greatly in type, but geese have remained much the same throughout the ages and the number of useful breeds are very few. Other types of poultry have been improved greatly in egg production and table quality but geese, if anything, have deteriorated over the past fifty years or so. Most of the geese seen on farms today can be said to be of the "barn-door" type and can hardly be called breeds at all, although they usually go under the name of Embden $\times$ Toulouse cross, a name to which they have little if any right.

These birds vary considerably in size and quality of meat from farm to farm. Some are quite large and of good table quality, the ganders weighing up to 20 lb at nine months of age and the geese up to 17 lb. Others are small and poor, weighing not more than 10–14 lb. Since this difference is largely due to selection by an individual breeder, great care should be taken when buying new stock, as the name given to a goose by the seller may mean almost anything unless he is a reputable breeder. The common goose is usually found in three colours; mainly grey with white edging to the main body and wing feathers and a white abdomen; a pure white, and one with grey neck, back, and wings, white breast and under parts. There is also a light, salty-blue one and a buff, but these two are rare.

All these colours can appear from one mating of the common goose; but they can be bred true to these colours by selection, and the name *English-Grey*, *English-White* and *English Grey-back* has been given to the three common colours. The Grey-back has also been called *Saddleback* and *Pomeranian* as it is very common in that part of Germany where it seems to have been bred, more or less true to colour, for very many years.

English-Grey, English-White, English Grey-back

Under the above names can be classed the various colours of geese found in this country and known as Embden $\times$ Toulouse. The white is, perhaps, the one most worth improving, but there are good strains to be found of all three.

Weights vary greatly from strain to strain; but a weight of from 17–20 lb would be suitable for the gander and 14–16 lb for the goose.

Egg production also varies; but may be said to be between 30 and 40 eggs in a season, laid in two or three clutches. In a few strains up to 80 eggs are sometimes produced, usually by very hardy geese that are generally good sitters and mothers and are the best types for the general farm.

Embden

The Embden goose appears to have been imported from Germany in the early part of the nineteenth century. In 1815, both male and female were referred to as being white and of "very uncommon size", but in spite of

this, they do not appear to have become very popular at first. By 1872, weights of well over 30 lb had been obtained and in 1929 the British Standard was 30–34 lb for the gander and 20–22 lb for the females.

Toulouse

The Toulouse is a grey goose and was imported from Southern France by the Earl of Derby in about 1840. They were then called Mediterranean, Pyrenean or Toulouse but the last-named is now the only one used.

Like the Embden, they seemed to be much larger than the common British goose; but not so large as the Embden, the Standard weight being 28–30 lb for the gander and 20–22 lb for the goose.

Both these breeds were used to cross with the common British goose and its size was much increased by such crossing. Both breeds, however, can be looked upon as purely exhibition or “fancy” in their pure state and of little economic value.

Auto-sexing Geese; the Pilgrim

Auto-sexing geese seem to have been known for many years for most of the old writers suggest that the “common gander is invariably white” and when the Embden was first introduced in this country breeders were surprised that both sexes were white.

Common geese in the West Country were usually white in the gander and grey in the goose, but as with auto-sexing in poultry, little notice was taken of this and the spread of the Embden and Toulouse breeds seems to have almost destroyed the auto-sexing strains. Although there are two wild species of geese which are auto-sexing — *Chloëphaga hybrida hybrida* or the Rock or Kelp goose, and *Chloëphaga picta picta* or Upland goose, both from the Weddell Sea area — there is no evidence that these were ever domesticated or crossed with domestic geese.

Domestic auto-sexing geese would appear to be from the same origin as that of all domestic geese. In Britain no name was ever given to these geese, but in America they are known as Pilgrim Geese because they were said to have been brought over by the Pilgrim Fathers and that name is now also used in this country.

The Pilgrim is a small to medium goose, and although there is no standard here, in America it is 14 lb for the adult gander and 13 lb for the goose. The gander is white with, sometimes, a few grey feathers; the goose is a soft grey, like the Toulouse; but lighter in shade and with more white on neck and underparts. The eye of the gander is usually blue and that of the goose, hazel.

Sexing at day old is simple and, in true strains, 100 per cent accurate. When the difficulty in sexing geese is taken into consideration, it is surprising that this very useful breed was allowed to become almost extinct. However, there was a craze for great size in all poultry from about 1860 to 1900, and many economic qualities in ducks, fowls and geese were almost lost during that time.

Auto-sexing in Down Colour

Another type of auto-sexing has been noted in certain white strains of geese. Here the sexing is in the colour of the down only; both sexes becoming pure white as the feathers grow. Grey in the down of a strain of Roman geese

was noted by the writer in 1926. It was later found that, where both cream and grey down was seen in such a strain, the males were cream and the females grey. Both were white as adults. Sometimes all the goslings showed some grey in the down and usually the lighter-coloured ones were male and the darker female. In the late 1930s it was noted that some strains of Embdens showed this grey colour in the down, and with a little practice, fairly accurate sexing could be obtained with this colour difference in the day-old goslings.

In 1952-53 a cross with White Chinese and Embden, showed some sex difference in both down and bill colour. Here darker and lighter down colour gave fairly accurate sexing, but the adult plumage gave no pure whites in the females and only about half in the males. The same breeder also noted the Auto-sexing down colour in his strain of Embdens and appears to conclude that all Embdens are of this type. This has not been the writer's experience, who had noted that all pure strains of Embdens up to the late 1930s showed no grey colour in the goslings.

The strain of Embdens at Chiddenstone Castle in Kent, now dispersed, showed no grey in the down of the goslings; some, but not all strains of Embden and Roman can be used for this down type of auto-sexing, but some selective breeding would be needed to ensure accuracy.

Buff

Early writers on the subject do not mention buff geese; but there is little doubt that buff "sports" from the common grey goose have appeared from time to time for many years. The colour is possibly due to crosses with the Fawn Chinese, but there is no real evidence of this. In 1928, Sir Rhys Llewellyn obtained some buff geese from a Breconshire hill farm, bred them up and called them Brecon Buff Geese, by which name buff geese are usually called in this country. They were recognized by the British Poultry Club in 1934.

Buff Geese are medium-sized, good table-quality birds and fair layers; combining attractive looks and usefulness while making less noise than the Chinese. Their colour is similar in marking to the Toulouse; except those parts that are grey in the Toulouse are a medium to light buff. The adult gander weighs 19 lb and the goose 16 lb.

A *Buff-Back* is also bred, similar to the Grey-Back except in colour.

Chinese

The Chinese goose is said to have ranged all over China, Siberia and North India and has been known as the Knob goose, Spanish goose, Polish goose, Muscovy goose, Siberian goose, Guinea goose and Swan goose! It has a swan-like neck and is thought to have been bred from the wild goose of China and not from the Grey-Lag, although it interbreeds with the common goose, the Grey-Lag and, according to Cuvier, with the White-Fronted goose.

It seems to have been known in Britain in the eighteenth century and used to be a good layer, although today many strains are little better than the common goose. However, the writer has had Chinese geese laying in November and records of up to 140 eggs a bird in a year, equal in weight to over 300 hen eggs!

There are two colours: *Fawn* and *White*. In the Fawn, the body colour is a fawny-brown with white edging to the feathers on the back and wings.



ORNAMENTAL DUCKS

Above: Mandarin ducks and drakes

Below: A pair of Pintails



Above: Utility Aylesbury
Below: Khaki Campbell



Above: Pekin
Below: Mallard



SOME BREEDS OF DUCK



Above: Embden

Below: Toulouse gander



Above: Grey Chinese gander

Below: Canada goose



SOME BREEDS OF GEESE



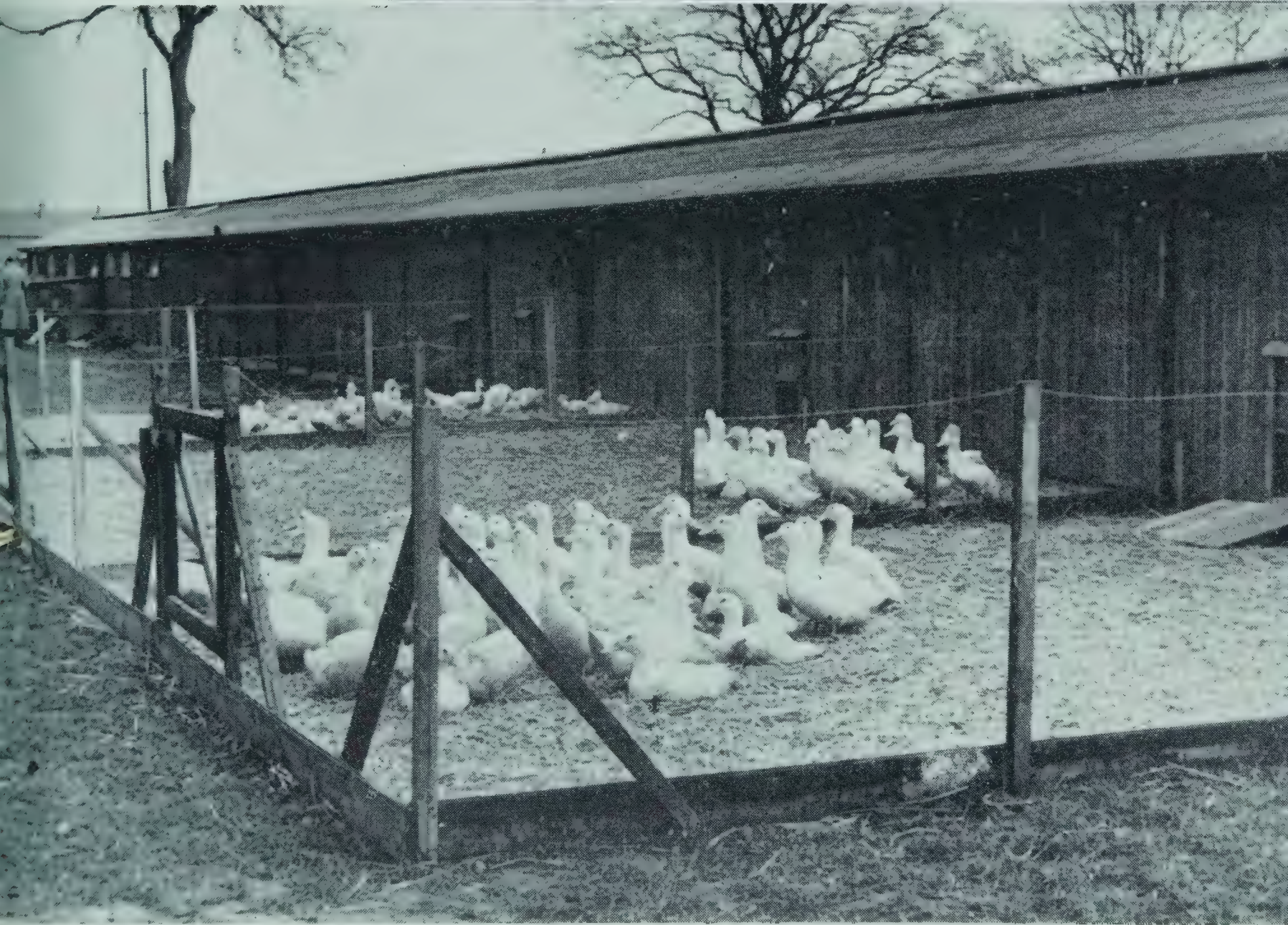
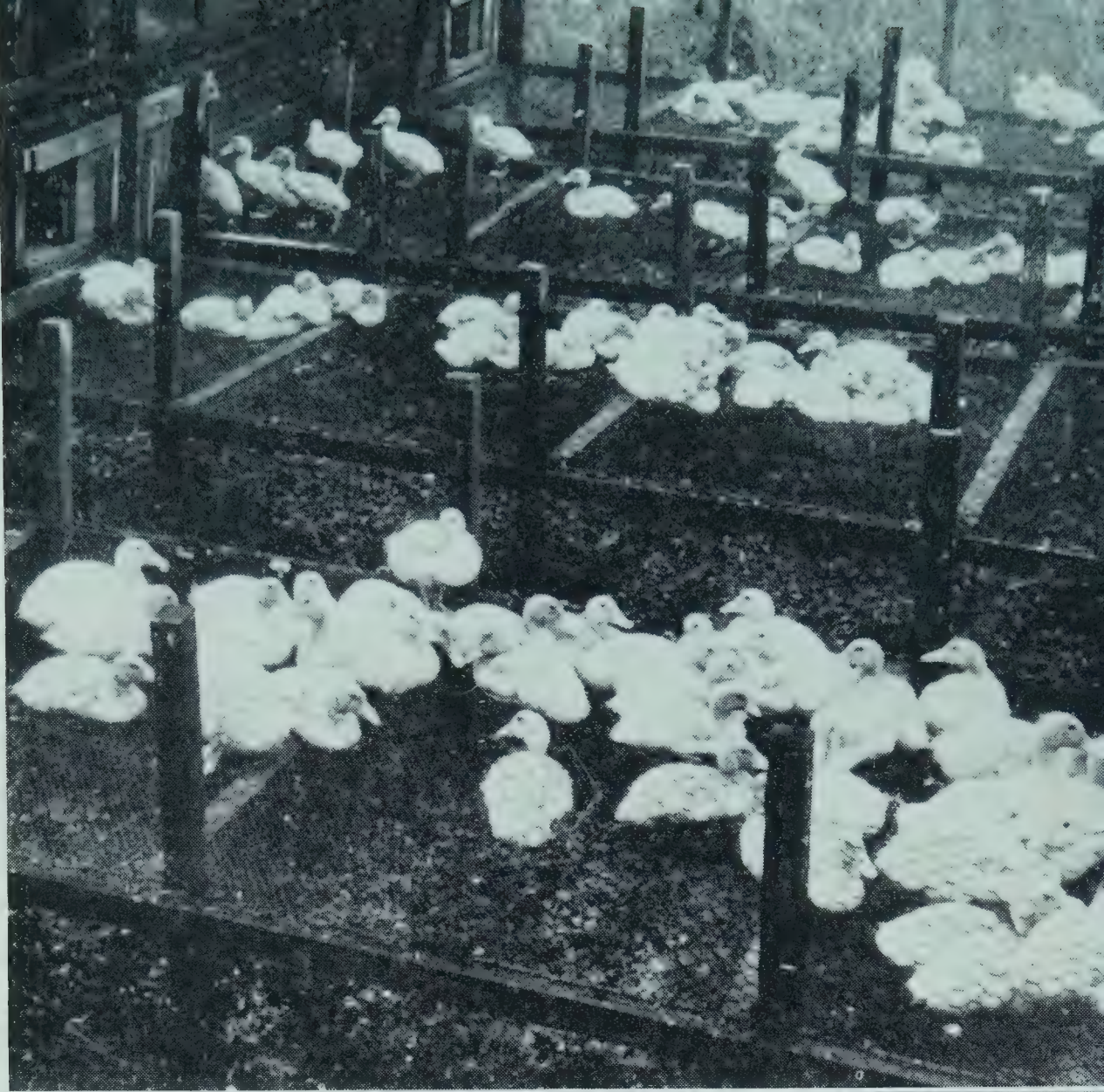
Infra-red Brooding



Battery Brooding

BROODING

Rearing with Sun Parlours



RING DUCKS

Fattening in Straw Yards



DUCKS (contd.)

Rearing and fattening
range

A GANDER

Position of hands for opening vent

The sex organ has been exposed; note the pale colour compared with the outer skin and inner surface of the vent of a goose illustrated opposite



VENT

SEXING GEESE

The head of the bird is held between the knees, leaving hands free to open vent

More force is needed to open the vent of the gander

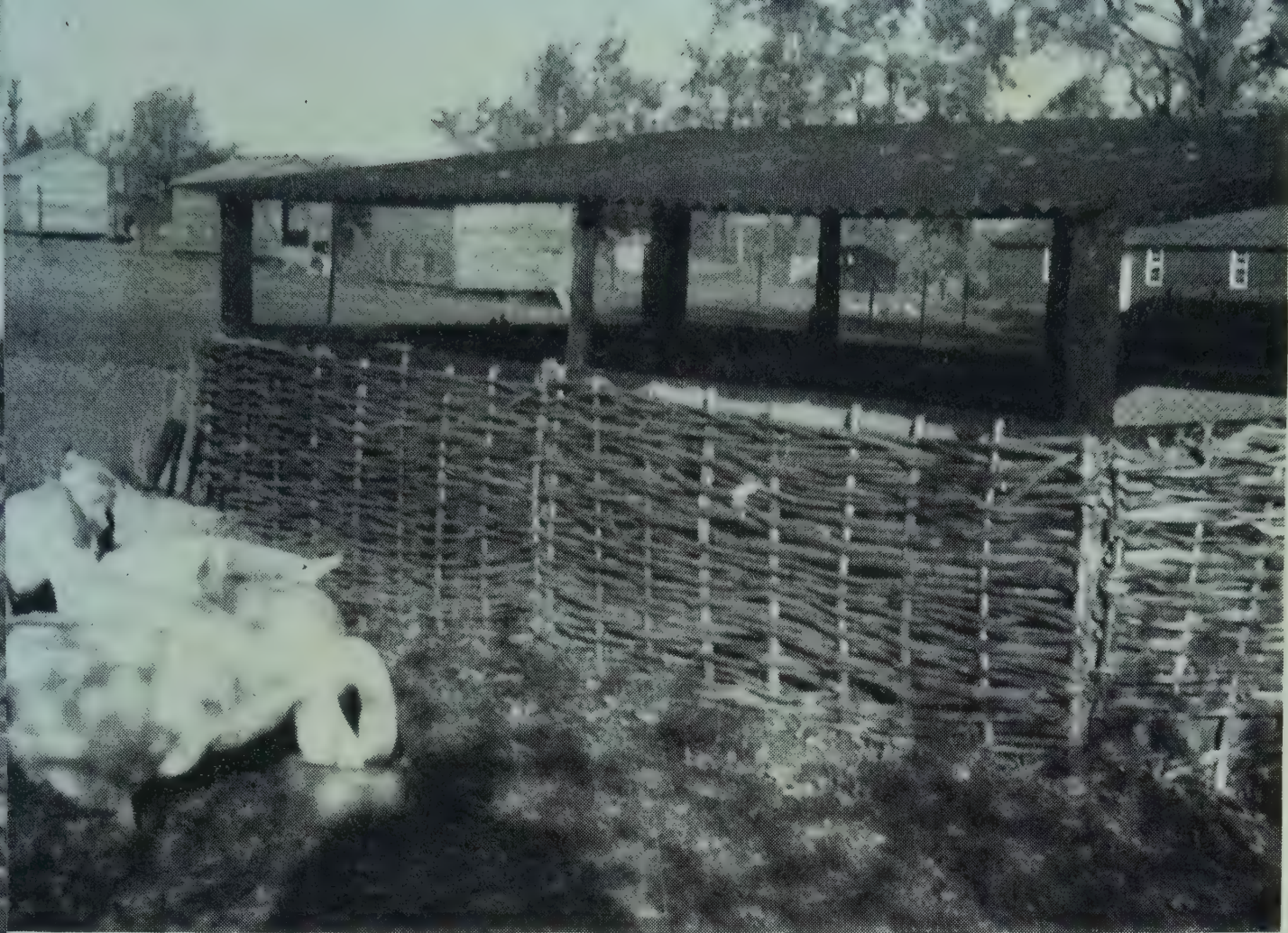


A GOOSE

Position of hands for opening vent

Wings should be held up by the arms and not allowed to hang loose (see opposite); note darker inside of the vent of the goose

ADULT GEESE



For all but v
young geese, thi
of house gives a
protection from
weather and fox



Foreground gras
grazed by geese
almost free of but
cups; cattle-gra
field beyond is th
with this weed

GEESE (contd.)

Above: Simple goose house of wattle hurdles and wire netting with corrugated-iron roof

Below: Improvement of pasture by geese

The front of the breast and neck are light brown. The top of the head and back of the neck are dark brown. In crosses with the grey goose this dark neck strip is transmuted to dark grey. The neck stripe, but not the brown colour would appear to be dominant. The bill and knob are black or dark green, the latter being at the base of the bill, and much larger in the male than the female. The legs are dark orange.

A White Chinese has orange bill, knob and legs.

In the pure state, Chinese geese can be sexed at about 6–8 weeks because of the gander's larger knob. This is a very useful character and it seems a pity that in this country it has almost been bred out in one strain, making it just as difficult to sex as the common goose.

The Chinese is a very small goose weighing little more than 12 lb for the adult male and 10 lb for the adult female. As a table bird, therefore, the breed is no larger than a large duck, and as it has also darker flesh and its dense down makes plucking difficult, it is not a popular table variety with the trade.

However, many people prefer the flesh of this breed to that of the larger birds as it does not carry so much fat, and has much the flavour of the wild or Canadian goose. For the private house with a small paddock or orchard, this is a very useful goose to help keep down the grass and provide meat and eggs for cooking. They are ornamental, very good "watch dogs" and can be killed at any time from eight weeks old.

Roman

The Roman is a medium-sized, white goose; a better layer than the common goose, but not so good as the Chinese. Since it is one of the most economic of our pure-bred geese it is a very useful breed for present-day requirements when a very large, fat goose is not required.

Some claim their Roman origin as direct descendants of the geese which saved Rome during the siege by the Gauls in 365 B.C., but although white geese are mentioned by Homer, Livy, etc., there is little evidence that this breed had anything to do with Rome. A Belgian writer was probably the first to refer to a goose of this name; in Britain and America it is not mentioned until after 1912.

One authority suggests that this breed should be kept small, and states that it is very suitable for killing when in first full feather; but, oddly enough, "broiler" goslings have never become popular, although they are very good to eat and are the cheapest form of meat to produce.

Adult weights have been put at 10–14 lb for the male and 8–10 lb for the females, but the lower weights would bring them into the Chinese class, which seems a little too small. The suggested 15 lb for the adult gander and 13 lb for the adult goose, seems more appropriate.

There is a *Crested Roman* goose bred in America, but although crested geese often appear as sports in English geese, no crested breed has been produced in this country.

African

The African goose is fairly popular in America; but is not often seen in this country. It is like the Chinese in colour and type, but less swan-like, with a larger, deeper body. Its most striking feature is a large dewlap, similar to the Toulouse. Some think that it was produced from a cross between a

Chinese and a Toulouse. It is certainly an old breed, but its connection with the Toulouse is doubtful. Its colour varies from brown, like the Chinese, to a brownish-grey; the adult gander weighs 20 lb, the goose 18 lb.

Sebastopol

The Sebastopol, sometimes known as *Danubian*, is a large, white goose with long curling feathers on back and wings. It is fairly common in the Black Sea area, and is also found in parts of Hungary, the Balkans and in regions of the Lower Danube. It is said to have been first imported into this country after the Crimean War.

In economic value it equals the English goose, but in this country is usually kept as an ornamental bird. Constant inbreeding at the Kent Farm Institute produced geese with feathers similar to that of the Silky Fowl.

Other Breeds

The *Egyptian* goose was probably domesticated by ancient Egyptians from wild stock. It is a very striking ornamental breed, being small with very beautiful plumage, shading from chestnut-brown to yellowish-red, but it is a poor layer, often not laying until two years old.

Crested geese appear as "sports" from the common goose and can often be seen in farmyards and, as already mentioned, there is a Crested Roman goose bred in America, although no attempt seems to have been made to produce a breed with crests in this country.

A number of wild geese are kept as ornamental birds, chiefly; *Bean*, *White-Fronted*, *Barnacle*, *Canadian*, *Grey-Lag* and *Pinkfeet*.

BREEDING METHODS

No experimental work has been done on breeding geese, so there is no exact knowledge on this subject. Exhibition types of some breeds have been improved, but as exhibition standards are often opposed to utility requirements, this is of little help.

FEEDING

The average goose lays at about the end of February and will lay two clutches of from 15–18 eggs each in a season. Earlier laying can be induced by good feeding. In 1815, feeding grain throughout the winter was recommended for breeding geese and, just before egg-laying was expected, a diet of boiled barley, malt, fresh grains and fine pollards mixed up with ale! Although ale is hardly economic to feed at present prices, boiled grains, wheat, barley or maize, are very good feed for breeding geese when about 5 per cent of dried yeast or skimmed milk are added. Most breeders now feed a poultry breeders' mash or pellets which give quite good results.

With good grass range, swimming water is not essential for fertility, although results are more reliable where it can be provided. If swimming water is not available, a trough large enough for the geese to get their heads and necks into the water should be provided.

In the wild state geese pair and mate for life. Under domestication geese also mate for life, if given the chance; but a gander will mate with several geese. The old breeders ran 5–6 geese with a gander, but most modern

writers suggest only 2 or 3, except for Chinese geese, where 5-6 geese can be run with one gander.

With the smaller English, Roman and Chinese geese, 5 geese to a gander is satisfactory but with the large exhibition types, 2-3 geese will be sufficient for one gander.

MAKING UP "SETS"

Geese do not take to each other readily like fowls, turkey and duck; but must be well used to each other before they will breed. All the geese in a "set" (i.e., breeding pen of geese) must be friendly with each other, and the gander must have been with them for some time before they will mate. Six weeks is about the shortest time that a gander and goose should be together before fertile eggs can be expected, and the longer the period, the better the results. This is possibly why second-year geese often give better results than first year. It is often said that the first egg of a goose is always infertile. This is not correct, but the idea may have arisen because the birds have not been together long enough for fertility.

For good results sets should be made up by Christmas or earlier for the next season's breeding, and good sets should not be broken up as long as they remain good breeders.

Geese will remain profitable for many years. The writer has known a 25-year-old goose give 100 per cent hatchability of all eggs. There are records of geese breeding for 70 or more years; but 10 years for a goose and 4-5 for a gander may be taken as the average useful life of these birds.

Replacements

Should a gander die or become infertile, his geese will take to another gander after about 6 weeks or more; but it is not possible to add another goose to a set if one should die or more are required. Should a goose die it is better not to add other geese, but if this is proposed, the gander must be taken away, out of sight and sound of his geese. If possible, the geese should be taken to another field or house and the new goose or geese should be added there. If they drift apart, they should be confined to a small run until they are feeding together happily. This will take from a month to six weeks at least; furthermore, the gander must not be returned to the geese too soon or he will drive the new birds away, even if the original geese have taken to them.

MATING

Several sets can be run in one field without wire netting pens provided that there is a separate house for each set and that they are mated before they are run together. The sets should be mated in small temporary pens some distance from each other.

When they seem to be mated, each set should be put in its own house and left there for a day. After that they can all be let out but will keep in their sets. It is best to feed each set near its own house.

A number of geese and ganders can be put together in one field and in one house and allowed to choose their own mates. This can be done where it is desired to keep down the grass in paddock or orchard rather than to have the best breeding results; but naturally some geese and, possibly, a

gander or two will be left unmated with the result that some of the geese will be quite infertile and some ganders may take too many geese for best fertility.

As with all livestock, some ganders and some geese are infertile, but most infertility is due to the birds not being together long enough, or to the gander ignoring one or more of his geese.

Where all eggs are infertile, it may be due to an infertile gander, but often because of a sexing mistake, the so-called "gander" is really a goose. Similarly, as a result of errors in sexing, it is possible for all the set to be comprised of ganders, when naturally no eggs will be forthcoming.

Poor hatches of fertile eggs may be due to bad storage of eggs which should never be kept too long or in hot, dry and draughty places. Inbreeding can also be the cause of poor hatches, although geese can withstand close inbreeding longer than most stock.

Poor feeding is another cause of bad hatches.

SELECTING BREEDERS

Although exceptional egg production of certain geese have been recorded over a long period of time, little or no attempt has been made to improve average egg production. It would certainly pay to do so, because even if all the eggs were not used for hatching, they fetch quite a good price for eating or cooking purposes.

Selection from the best layers and the best breeders, those whose eggs hatch best and whose goslings rear best, is well worthwhile. Since geese are mainly kept for table an obvious selection is for the best breast meat. The breeder will notice that some well-fed birds have breast bones which stand up above the breast meat, others have the breast bone and meat almost level and a few show a recessed ridge along the breast where the breast bone is. In other words, the breast bone is below the flesh and in America is called "dimple breast".

These "dimple-breasted" birds should be selected for breeding if possible. If there are none in the flock, those with breast meat and bone on a level should be chosen; high-breasted birds should not be used as breeders. Selection for width and length of breast should follow. Within the size of the bird, the longer and wider the breast the better. It is said that a pig should be all hams: ideally, geese should be all breast.

Breeders should, of course, be strong, healthy, well balanced, medium in length of leg and of the size required. From 10–12 lb for the goose and 12–15 lb for the gander, at Christmas time, is the most popular weight. There is little demand for the large 20-lb birds, and birds under 10 lb — except for special retail trade — would have to compete with the more popular duck.

Incubation

GEESE EGGS take from 28–30 days to hatch. The goose is usually a good hatcher and mother; but, if eggs are to be hatched by the goose, a number of large boxes or “hides” should be made near the goose houses but some distance from each other. There should be at least one box for each goose, and straw and a china egg should be placed inside some time before eggs are expected, to ensure that each bird has her own nest. Otherwise, if more than one goose lays in the same nest there will be trouble when one goes broody and hatches could be spoilt.

When a goose goes broody she should be shut on her nest so that other geese do not worry her, but she must be let off to feed once a day. If she does not come off of her own free will she should be taken off each day because geese have been known to starve themselves almost to death when sitting with the result that the hatch is likely to be poor. This period when she is off her eggs is apparently necessary for optimum hatching.

At hatching time the goose should be shut on her nest until the hatch is over or the other geese may interfere with her. When all the goslings are ready to leave the nest they can be let out with their mother and, provided that the grass is not too long, may be allowed to run with the other birds. The gander will help to look after the young goslings; in fact he makes a very good “mother”.

HATCHING UNDER HENS

On many farms the first clutch of eggs laid are collected each day and set under hens. When the goose goes broody, she should be shut off her nest, after which she will soon lose her broodiness and about three weeks later will start to lay. This is another reason why separate nests for each goose are desirable, for if several geese lay in one nest, the broody must be shut up in a cage or crate for about 3–4 days. During this time she must be fed and given water, and the cage must be within sight and sound of the other geese.

The goose is then allowed to sit on her second clutch which would, normally, be the last of the season; but Chinese and other good layers may, if allowed, lay 3–4 clutches in a season.

Hens are set in the usual way. It is generally suggested that the base of the nest should be made up of earth or a sod of earth because this will hold the moisture; it is also a good foundation for the nest which should be made of straw or hay.

After the hen has been sitting on the new nest for several days, the goose eggs may be placed under her. A good hen will take 4–6 geese eggs according to the size of the eggs and the hen. As with hen eggs, the hen is let off to feed only once a day.

When she is let off, about a cupful of water should be poured into one corner of the nest so that it soaks into the earth foundation. This will provide all the extra moisture needed and the eggs need not be sprinkled with water as is often suggested. Added moisture in the hatching of water fowl eggs is nearly always overdone.

It is usually suggested that the eggs should be turned by hand when the hen is let off to feed, because it is thought that a hen is not able to turn the large eggs herself. Hand turning once a day will do no harm, but it is quite unnecessary as the hen is well able to turn the eggs herself and also to move them from place to place in the nest.

ARTIFICIAL INCUBATION

How to achieve really successful incubation of goose eggs in incubators is not yet fully known and much conflicting advice is given. For example, as the normal temperature of the goose is slightly higher than that of the hen, it is difficult to see why it is suggested that the incubation temperature should be run one degree lower for geese than for hen eggs. This idea possibly arose from using an older type of incubator, where it is not possible to alter the height of the thermometer. The bulb of the thermometer is, therefore, about a quarter-way down the larger goose egg instead of just at the top, as with the hen egg. In such a machine, the temperature should be lower, but in hot-air, natural-draught machines where the thermometer can be adjusted, it is better to raise the thermometer so that the bottom of the bulb is just at the height of the top of the average-sized egg. The temperature should then be run as for hen eggs, i.e., 103°F.

Eggs should be turned twice a day at 12-hourly intervals. All moisture devices supplied with the machine should be kept filled throughout the incubation period. In hot-water machines, such as the Hearson, no extra moisture is needed and it is advisable to air the eggs after turning for about 5 minutes in the second week, 10 minutes in the third and 15 minutes from then to the 28th day. In hot-air machines no airing is needed; but one felt should be removed on the 10th day and the second on the 18th day. The inside of hot-air machines may be sprayed with water at about 120°F with a mist-type sprayer each time the eggs are turned; but it is best not to spray or sprinkle the eggs themselves.

Humidity

Most operators overdo the moisture and since each incubation varies, a careful watch should be kept. Goslings incubated under too low humidity are rather small and often have bits of shell sticking to them; those hatched under too much humidity are rather large and the down does not fluff out well. A note should be made of those that "bill" the shell and then die. If the shell is just broken and the gosling dies with its bill sealed with a sticky substance, humidity has been too high. If the bird bills the shell some way round the egg and then dies, humidity has been too low.

Ventilation

Poor ventilation in the machine or incubator house will have a similar effect as too high humidity and this point should be watched. Poor ventilation usually gives a high mortality at about the 20th day.

Few breeders use cabinet machines; but the "paddle" type have given good results. With some machines every other setting tray must be removed or the goose eggs cannot be inserted; but sometimes they can be laid flat and every tray utilized. These machines should be used as for hen eggs; in some makes of incubator the temperature can be $\frac{1}{4}$ °F higher than for hens but this can only be determined by testing at various temperatures.

Eggs can be tested, just as for hen eggs, on the 7th and 20th day. Infertile ones and dead embryos should be removed.

Although the goose and hen can hatch eggs of over a week old reasonably well, the incubator cannot do so. Hatchability deteriorates very sharply after the fifth day of storage and, if possible, no egg of over 7 days old should be set in an incubator.

A good idea of the humidity can be obtained by observing with a testing lamp the amount of drying down which takes place within the egg. A number of eggs should be tested, and an average taken since some eggs dry down more quickly than others, and testing a single egg might not give a true picture.

When humidity has been too low, as many goslings as possible should be helped out of the shells otherwise they will die. If not too far gone, they will rear quite well.

Calculating Machine Capacity

One goose egg takes up the space of roughly 3-4 hen eggs, and as the capacity of all incubators is given in hen eggs, a good idea of the goose-egg capacity of any machine can be obtained by dividing the hen-egg capacity by four. If only every other tray is used in a cabinet machine, allowance for this must also be made.

The special incubators now made for turkey eggs will be found better for geese as more room between trays is given.

Brooding and Rearing

UNDER natural conditions, goslings reared by the goose will remain with the flock until the next breeding season, when the old birds drive the younger ones away. With commercially-reared geese this does not happen, since the young birds are usually sold off by Christmas, but there is no harm in allowing the young birds to remain with the old ones until sold.

MARKING

By Christmas, it is often difficult to tell old from young, so it is advisable to mark all young geese at an early age. This can be done at about six weeks old, by using leg rings or, at day old, by slitting the web or webs of the feet. This is best done by making a V-shaped cut in the edge of the web. As geese have a way of punching holes in their own webs by treading on sharp objects, toe punching similar to that used for marking chickens is not advisable. Unless a large number of toe marks are needed, as in pedigree breeding, the best place to slit the web for age is on the small flap of skin that will be found on the outside of the inside toe. A different mark or combination of marks can be made for each year. It is also a good plan to sex the goslings at day old and to mark the web for sex as well as age because it is difficult to sex the birds again until they are mature: (See sexing of geese on page 68).

NATURAL BROODING

The goose or hen will automatically brood the goslings; in fact, hens will remain with them long after they need brooding. There is no harm in allowing this, but, if wished, the hen may be taken away when they are three weeks old.

When rearing goslings, it is very important to prevent them from running in long, wet grass or being out in heavy or continuous rain until they get their first feathers, otherwise, they will get chilled and die. The mother goose will look after them in wet conditions, but the hen may not and, with artificial rearing, they must be driven indoors during heavy rain for the first 3-4 weeks of their lives. However, goslings can swim in water when only a day old and come to no harm.

ARTIFICIAL REARING

Any type of good chicken brooder will be found suitable for geese, but like ducks, they make rather a mess of cloth curtains or canopies and brooders needing these are not advised.

Brooders with steep run-ups, such as the warm floor type, are not suitable for goslings and, although they can be reared on wire floors, they are better on a solid one. About 15-20 goslings, according to size, may be placed in one 100-chick brooder, makers' capacity.

Infra-red Heaters

If oil heating is used, the pyramid type is possibly the best, but electric brooders are more suitable and infra-red heaters are almost ideal. Both dull and bright emitter infra-red lamps are equally good for the rearing of goslings, but if the latter are used, the drinkers should be placed well away from them as goslings are apt to splash the water about quite a lot, and should the bright emitter lamp be splashed with cold water it will be broken.

The same heat is required as for chickens, i.e., 100°F on the floor of the brooder and about 6 in. away from the heater. With infra-red heaters a mercury thermometer will not give a true reading, but red and especially blue spirit ones give a near enough reading for practical purposes.

Infra-red lamps usually need to be hung lower than the makers suggest. A good guide to the height of these lamps is to note the position of the birds when asleep at night. If they will not sleep directly under the lamp, but form a circle around the centre, leaving an open space beneath the lamp, all is well. If they crowd right under the lamp, it is hung too high.

Goslings will go right under an infra-red lamp during the day time but will remain there only a short time. Should they tend to crowd under the lamps in the daytime the lamps should be lowered.

After the first week, goslings need very little heat, but they do need some until they are about three weeks old, when no heat will be necessary but their litter should be kept dry and clean. Goslings need cleaning out much more often than chickens, and as their droppings are much wetter the litter soon becomes sodden if not changed. Damp litter will cause poor growth.

MANAGEMENT

As previously mentioned, goslings should be allowed to run on short grass at the earliest possible age. With hen and artificial rearing, the birds should

be restricted to a small pen or run for the first two weeks. After this they will be able to find their way about quite well and may be given almost unrestricted range.

Almost any kind of poultry house with a solid floor is suitable as a brooder house for goslings up to eight weeks old; after this time almost any rough shelter will do, so long as the floor can be kept dry. If allowed to do as they like, goslings of eight weeks old or over would probably choose to sleep in the open air or on a pond if they had access to one. This would be all right in sheltered districts in the South where there are no foxes, but it is safer to provide some housing.

Geese are easily driven and, when they have their feathers, if they have outgrown their portable brooder house, they may be housed in a shed, stable or other buildings for the night and driven to a pasture for the day. If they are given a small feed when they come back, most of them will come home on their own at shutting-up time.

It is not practicable today, but in the days when there were wide grass verges on the sides of the roads, it was common in South Lincolnshire for the cottager to hatch and rear goslings to about eight weeks of age, running them on the roadside grass where they would be "tented" or guarded by the children. When the geese were large enough, the farmer would take them over, housing them in cattle yards and driving them to the fields, and later the stubbles, for the day. About six weeks before Christmas or Michaelmas, they would be given a large feed of oats when they came in at night. Many thousands of geese were reared in this way and when sold the farmer and the cottager divided the proceeds equally.

FEEDING

To show any profit geese must have access to ample, short and growing herbage. It is quite wrong to think they will do well on long, coarse and seeded grass. Young geese may starve to death on such a pasture and older birds will eat little but the seeds of the grasses. At the same time, geese will eat many weeds and herbs which other animals will not touch. For example, geese will clear a field of buttercups, eating both top and roots. They will also clear creeping thistle, if given time and are put on it before it gets too big. Thus, they improve weedy pastures in a very short time.

Autumn and Winter Feeding

The aim should be to give as little grain or mash feeding as possible. In the autumn and winter and those periods when grass is not growing, extra feed should consist, as far as possible, of vegetables and roots, such as cabbage, kale, turnips, swedes, mangolds, sugar and fodder beet or potatoes. All these can be given raw, but the larger roots should be put through a root pulper or cut up so that the geese can eat them. If birds of over six weeks old are given as much of this food as they will eat, they will only need grain or mash in very hard weather, for breeding or fattening.

If fed on grain or mash alone an eight-week-old gosling will eat at least $\frac{1}{4}$ lb a day which is quite uneconomic.

Grazing

Goslings, if given the chance, will start grazing before they are 24 hours old, and if on ample good and short-growing pasture will do well with no

additional food. If it is not always possible to give such good pasture and if they are reared under hens or by artificial means, some feeding will be needed.

With hen rearing, the coop and run should be on good short grass and the run moved several times a day, if that can be done. A little of any good make of chick crumbs for the goslings and grain for the hen is all that is needed in the way of food for the first two weeks. After this grain alone, with good grass is sufficient.

With artificial methods of rearing, chick crumbs may again be the first food and, whenever possible, the goslings should be allowed to run out on to short grass during the first three days. Goslings do not take kindly to intensive conditions and both for their well-being and for economic reasons they should be running out as soon as possible.

Alternatives to Grass

Should it be necessary to keep them intensively for longer than three days they should be given something to nibble such as turves of grass, cabbage or other vegetables. If this is not possible, strips of cloth should be hung up for them to play with. If this is not done they will start on each other's down and, in a very short time, they will be nibbled bare on backs and heads.

When necessary, cooked potatoes and other roots can form their main feed after three weeks old. Grass over 4 in. long is not suitable for young goslings unless grain or good vegetables are given to supplement the herbage.

Goslings grow very quickly and will reach from 8–12 lb in twelve weeks, according to breed. After this they will grow more slowly and may not exceed this figure by more than 4–8 lb. Chinese goslings will be about 2–5 lb when adult.

How many Geese to an Acre?

Although it is not easy to give the number of geese that can be run on an acre of grassland, 5 geese will probably eat as much grass as 1 sheep. On this basis, if one acre of very good land keeps 5 sheep, one acre of average land, 3 sheep, and one of poor land, 2 sheep, the number of geese to an acre would be respectively 25, 15 and 10.

SEXING

Except with auto-sexing geese and the Chinese and African, where the larger knob of the male can be seen at about 8 weeks old, it is not possible by outward appearance to tell the sex of geese until they are at least nine months old. Even then it needs some experience to do so. The gander is usually slightly larger than the goose, has a longer neck and a larger more bull-like head. The normal voice of the gander is high and shrill and that of the goose is lower pitched. The alarm note of both sexes is much the same.

When approached, especially if one has a dog, the gander or ganders will come to the outside of the flock, although both will lower their heads and hiss.

Sexing at Day Old

An experienced gooseherd will make very few mistakes in sexing geese by appearance, but the only sure way is to sex by the vent. This is best done at

day old and the goslings marked to sex, since after this stage, it is possible, but very difficult to sex by the vent until the birds are mature.

The gosling should be taken in the left hand, the head down and the breast to the palm of the hand. The back of the middle joint of the index finger of the *right* hand should be placed just below the tail which should be grasped between the index finger and the thumb and pulled back and down. At the same time the vent should be opened with the thumb and index finger of the *left* hand. In the gander the male organ will appear as a small protuberance about $\frac{1}{8}$ in. long.

Sexing Fully-grown Birds

To sex fully-grown birds, the bird should be held between the knees with its head out behind and the back of the bird uppermost. The tail should be grasped and forced back with one hand while the other hand opens the vent. With a gander, this may need a little force, but the vent of the goose usually opens easily. The inner surface of the vent of the goose is wrinkled and loose, the colour a dark pink to light red.

The inner surface of vent of the gander is smooth and a very light pink; the male organ, which is now quite large, is almost white in colour.

The colour of the inside of the vent must be noted as soon as it is opened because if the bird is a gander and some time is taken in exposing the male organ, or fully opening the vent, there will be some inflammation, and both sexes will have a rather red inner lining.

Another method is to have an assistant to hold the bird on its back on a table, or on the ground. Both hands should be pressed on either side of the vent to expose the inner surface.

The birds should be marked for sex at once.

Preparation for Market

IN goose production the greatest profit is made by those who hatch and rear 2-8 week-old goslings for sale to those wishing to grow them on. There is little profit in selling in the wholesale market where there is a slow demand and prices are very low.

There is almost no demand until just before Christmas when sales should be made either direct to the consumer or to a local shop. With either way, orders should be taken well before the selling date and a price agreed at the time the order is taken. Hoteliers are not usually interested in geese as they claim that they make an expensive meal.

If a good retail trade is built up or a good price obtained from shops, geese can be very profitable since they make about two-thirds the price of chickens and should not cost more than half as much in purchased food; usually very much less.

KILLING

Geese are usually killed by breaking the neck. One method is to take a broom handle or other stick of about this size. With the legs slightly apart and the goose grasped by its legs, put the head of the goose under the handle.

Stand on the stick with one foot on either side of the goose's head and give a sharp pull up. The neck will then be broken and a good gap should be left between the break and the head, so that blood may drain into the cavity thus made.

Another method is to put a loop of thin rope round the legs of the bird and hang it by this to a strong hook about 6 ft high. The head is then grasped in one hand turned at almost right angles to the neck and pressure put on the angle thus formed with the edge of the other hand. A sharp downward jerk will break the neck.

PLUCKING

Dry plucking is usual and machines of the comb type are quite satisfactory. The large and small feathers and the down should be kept separate as they are quite valuable, especially from white birds.

By the semi-scald method, the bird are dipped in water at between 125 and 130°F before plucking, but there is some trouble in drying the feathers if these are to be sold.

Birds sold direct to the consumer must be drawn and trussed. This is done much as for other poultry. The feet should be removed and the first joint of the wing taken off; this is usually done before plucking.

In the past, this joint with the feathers attached was used as a household brush, especially for kitchen range flues. The feet were also scalded, and the scales removed; the head was scalded and skinned, including the bill, and all were put in giblet pies. Thus, like the pig, almost all the goose was used except the "honk"! The feet are still used but the head is usually thrown away.

LOSS OF WEIGHT

The average goose will lose about 7.5 per cent of its live weight in feathers and blood, 22.5 per cent in drawing; which leaves about 70 per cent. Of this, some 6 per cent will be bone, leaving 64 per cent edible meat.

The average live weight of a medium-sized goose will be:

	<i>lb</i>	<i>oz</i>
At hatching		3-4
4 weeks old	2 - 3½	
8 weeks old	5½ - 7	
12 weeks old	7½ - 9½	
16 weeks old	8½ - 11	
20 weeks old	9½ - 12	
24 weeks old	10½ - 13	
28 weeks old	13 - 16	

Where the pasture is good enough to fatten geese without extra feeding, it would possibly pay to kill them at about 16 weeks old or before the pasture went off in the autumn and put them in cold store for Christmas. In this way, not more than 1 or 2 lb purchased food, mash and grain, would be needed to produce 11-12 lb birds.

Full particulars of eviscerating and trussing are given in Appendix II.

GENERAL

Ornamental Ducks and Geese

DUCKS

Ornamental ducks can be divided into two categories — the “made” or domesticated breeds, which have been bred by duck breeders to their present colour and type, and wildfowl which are in their natural state.

Although many of the domesticated duck breeds qualify, by their beauty, for the title of “ornamental”, the following breeds together with all wildfowl species are recognized by clubs as those which come under this heading. The wild breeds are fully described in many books on ornithology and, apart from the fact that the more colourful of these defy a written description, they are so profuse that it would be impossible to describe all those that are worth keeping in a collection. There are approximately 240 species and sub-species of wild waterfowl.

Black Cayuga

The *Black Cayuga* may not come under either heading, but its ancestry is obscure and if, as many people think, it is a sport from the Mallard, it might be included on the grounds that it is a direct descendant of a wild breed. Anyway, as a utility breed its qualities are doubtful, but for ornamental purposes its beauty leaves little room for doubt. The breed appeared in this country in the latter part of the nineteenth century and is said to have come from Lake Cayuga, New York.

Briefly, the Black Cayuga has an intense iridescent, beetle-green plumage with black legs as a young bird that turn to a brownish-orange with age. Its eyes are black, bill slate-black with a black saddle. It is a heavy bird weighing 6–8 lb and has a lively, alert expression, and a “clean-lined”, horizontal body which is clear of the ground.

Black East Indian

The *Black East Indian* (also known as the “Black East Indie”) is also considered by many to be a sport from the Mallard. It is generally accepted that the colouring of the Cayuga has been improved by crossing with the Black East Indian, which is a very intense beetle-green.

In type, the Black East Indian is short and broad with a short neck. Carriage is lively, smart and symmetrical and clear of the ground, resembling a small compressed version of the Cayuga. The drake of this breed weighs only 2 lb; the duck $1\frac{1}{8}$ – $1\frac{3}{4}$ lb.

Both breeds lay eggs varying in colour from black, at the commencement of the clutch, to off-white at the end of the clutch.

“Decoy”, “Kooi”, “Cali”, or “Mignon”.

These ducks originated on the continent for exhibition purposes.

There are two varieties of Decoy — the White and the Brown (or Grey).

The white is a pure china white with orange legs, feet and bill. The Brown is something similar to the Mallard in colouring, but the female has darker lacing and the male darker marking. Both from an exhibition and ornamental point of view the White variety should be bred as pure white as possible, free from sappy (yellow) feathering. Type of this breed is quite distinctive. The body should be short, cobby with close feathering and clear lines. The head is round and puffy with eyes set centrally, bill short, thick and dished. The Decoy should be bred as small as possible. Eggs are white to pale green.

Silver Appleyard Bantam

The *Silver Appleyard Bantam* duck was bred by Mr. Reginald Appleyard at Ixworth, Suffolk. It varies rather in colour as yet, but drakes of this breed are beautifully coloured and marked in a variety of colours, rose, white, black, grey, lustrous green, etc. As its name implies it is a very small bird for a "made" breed, approximately the size of the Black East Indian, or perhaps even smaller. Its type is different from that of other small breeds in that it is rather higher at the shoulders. The line from the tip of the bill to the back of head is straight. Eggs are white to pale green.

Any of the above breeds will lay a clutch of eggs varying in number, and if eggs are not collected, will then go broody and sit on them. If eggs are collected daily a much greater number are laid throughout the season.

Many of the wild species of waterfowl, British or exotic, breed well in captivity if kept in suitable surrounds. Most of them are well worth keeping in a collection for their beauty of colouring, different habits and voices.

Mandarin and Carolina

Without doubt the *Mandarin* and *Carolina* are the most colourful. The former comes from East Asia. In China, at weddings, a pair of these birds are given to the bride by the bridegroom as a token of fidelity. As a breed, the Mandarin duck mates in pairs for life and are very faithful to each other. The Mandarin is also known as the "Chinese Love Bird".

Mandarin and Carolina females are rather similar in colouring but differ in detail when viewed closely. Both of them are dowdy compared to their males and are roughly a dark grey with white markings. Both carry a crest.

The males differ considerably. The Mandarin has what appears to be "whiskers" — long pointed feathers from each cheek, and distinctive wing coverts which are lifted to look like sails when the bird is displaying. Both Mandarin and Carolina males have long crests which hang down to their shoulders and can be lifted at will when the birds are frightened or displaying.

Colouring of the Carolina (also American "wood" or "Summer" duck) male is not so varied, but the clear markings together with the brightness of existing colours puts him on equal terms with the Mandarin. As the bird moves, or as the sun catches it, the variety of tints and sheens which appear, from any of what would seem to be single colours, have to be seen to be believed.

Both these birds belong to the tree duck family, nest in the hollow trunks of trees and lay small white eggs.

Various Surface Feeders and Divers

Of the surface feeders the *Widgeon*, *Chiloe Widgeon*, *Shoveller* and *Pintail* are well worth keeping as they are all beautifully coloured and marked.

The *Red-Crested Pochard*, *Rosy-billed Pochard* and *Tufted* are diving duck which afford variety. The *Common Shelduck* (or "Burrow" duck) which nests in burrows is attractive and distinctive and a collection would hardly be complete without our common but highly ornamental Mallard.

These are but a few of the varieties of duck which can be kept. They differ in colouring, habits and voice and also cost less to start with than many of the breeds available.

As there is not the variation and brilliance in colouring in domesticated geese compared with domesticated duck breeds, one might imagine that the same would be true for wild geese. This, however, is not so. Wild species have a great variety of colour, size, habits and calls.

ORNAMENTAL GEESE

Because of the greater extent of grassland required for geese to graze, collections are more limited than collections of wild duck. However, one or two pairs of geese are attractive and entertaining, and many of the breeds become quite tame. Many would-be enthusiasts are deterred because geese do not breed well until three years old and the initial cost is high to introduce some of the more expensive varieties. To offset this, geese breed well for a number of years, and once established are inexpensive to maintain.

Canada, *Grey Lag* and *Egyptian* (or "*Nile*" goose) are amongst the breeds most commonly kept, and as they all differ widely the brief descriptions below show their variation. These are all inexpensive to buy — from £6–£8 a pair at present list prices — and breed well. Prices for other varieties are from £6–£40 and over for a pair, while some of the really rare varieties such as the *Ne Ne* (or *Hawaiian goose*) are unobtainable at any price. Only a few pairs of the *Hawaiian goose* exist in this country, at the Wildfowl Trusts' breeding grounds at Slimbridge, Gloucestershire, and at Leckford Estate, Stockbridge, Hampshire. The birds kept in these collections form nearly the whole of the world's population of this variety. But for the preservation and breeding carried out at these centres the variety would, by now, have been extinct.

If one is prepared to pay higher prices the *Cereopsis*, *Mageuan*, *Red Breasted*, *Crinoto* and many others are available from breeders who specialize in raising wildfowl.

Canada

The *Canada* has a striking and pleasing appearance. It has a black head, except for an inverted "V" of pure white extending up each cheek behind the eye, and a black neck, the black finishing in a clean line where the neck merges into the shoulders. The rump, tail and wing tips are also black. The breast is grey-brown, the abdomen white and the remainder of the body dark grey-brown, with each feather broadly laced with a lighter shade of grey. Legs and bill are black.

The *Canada* is a large and powerful bird with a long upright neck, fairly short legs, and a long body gently sloping from shoulders to tail which is fairly long and slopes downwards in line with the body. It is a really delightful bird, but one to be wary of in the breeding season as it guards its nest and eggs zealously. Its call is a deep "ker-honk".

Egyptian or "Nile" Goose

The Egyptian or "Nile" goose is unlike any other variety. In type it is rather similar to the Shelduck, with long legs, small body, round and prominent breast, rather long tail carried low, and upright neck giving it a very active appearance. Its colouring is rich. The head is fawn except for chestnut around the short, coral-pink bill, and a chestnut patch around each eye. There is a little chestnut down the back of the head and an uneven ring of the same colour about half-way down the neck. Apart from a very distinctive blob of chestnut on the breast (the "target"), breast and undercarriage are vermiculated fawn. Wings are chestnut, with white wingbars, body black and glossy green, undertail pinkish-brown, tail glossy black. Legs and feet are pink. Its voice varies in note and resembles a laughing cackle when the birds are excited and "talking" to each other.

These birds are well worth keeping for their looks, voice and for their prettily-patterned brown and grey goslings, but they are extremely vicious in the breeding season and should be safely penned from other birds and children at this time.

Grey Lag

The Grey Lag has head, nape of neck and upper part of back ashen brown. The lower back is blue-grey, each feather laced with lighter colour; quill feathers are leaden grey. Chin, neck and breast are grey, abdomen white. Legs are pink and bill pink with white horny tip.

In type the Grey Lag is long, narrow and shallow; long in the leg and of horizontal carriage. In proportion it has a shorter neck than the Canada. It is believed that most of our domesticated breeds were bred from the Grey Lag.

ENVIRONMENT

A large collection of waterfowl running together need space to move about without continually bumping into each other. This is especially necessary if some of the more antagonistic varieties such as the foreign shelduck are kept. For one or two pairs of duck a very small pen a few feet each way with a small pool a couple of feet in diameter will suffice. The ideal breeding ground for all types in a large collection is marsh, good grass and water with natural green food, such as watercress and duckweed, etc. Bushes and overhanging branches, reeds and long grass provide natural shelter in hot weather as well as in wind. Swimming water need be only 2 ft or less for surface feeders, whilst diving duck prefer a depth of 4 ft.

Housing is unnecessary, but there should be protection against vermin, stray cats and dogs by using 6 ft wire netting of $1\frac{1}{2}$ in. mesh. The bottom selvedge should be buried below ground level to a depth of 12-15 in. This will also prevent "pinioned" birds from escaping.

If natural shade and shelter is not available the pen can be planted with ornamental shrubs — members of the *Salix* family grow quickly from cuttings.

One side of a pool should have a slope to the water's edge as pinioned birds are not as nimble as birds which are fully winged, but apart from this, steep sides to a pool act as wind breaks and provide shade. An island also gives an added sense of security to the birds.

PROVIDING NEST BOXES

The main thing about the pen is to have it as natural as possible.

Nesting sites should be chosen for the breeds kept and should be available well before the nesting season. Birds naturally select more than one site before laying so that when special nest boxes have to be provided there should be more than one per breeding pair and these should be placed to give variety.

The Carolina and Mandarin usually nest in the hollow trunks of trees, so if possible, a tree stump should be planted at an angle for them to climb up it. About 3 or 4 ft off the ground a weatherproof wooden box or barrel with an easily accessible entrance hole about 4 in. square should be securely fixed so that the entrance faces away from visitors to give the birds greater seclusion when laying and sitting. A natural screen should be planted in front of the nest. It is unnecessary to provide nesting material.

For the Shelduck, old milk churns or something similar, can be "planted" horizontally, so that the open end is just visible.

Long grass or rushes close to water to form plenty of cover should be left for birds that nest on the ground — geese, the Pochard family, Pintail, Mallard, Teal, etc.

Birds will often oblige by nesting in large upturned wooden boxes that have had a portion cut out of one side; in such a nest the eggs are safeguarded against birds of prey. If an open nest is seen a natural "roof" should be placed high above it so that eggs cannot be seen from the air.

FEEDING

Out of the breeding season ducks and geese will thrive on a grain diet. During the breeding season it is advisable to add soaked biscuit meal or a balanced ration of breeders' food such as is used for domestic fowl. Geese should be fed sparingly to encourage them to graze; some of the duck breeds such as Widgeon are also almost entirely grazers. A feed should be given twice daily morning and evening, and should be sufficient to last for about twenty minutes only so that other birds and vermin are not attracted.

Young stock can be fed on biscuit meal or Baby Chick meal (the latter is a more complete diet), mixed to a crumbly moistness with water. They should be given green food daily, e.g., chopped lettuce, duckweed, lawn mowings of young grass. Ducklings of some breeds — e.g., Shelduck — require additional animal protein in the form of live water insects, crustaceans or fish scraps.

PINIONING

Ducklings and goslings can be pinioned to prevent straying by any of the following methods:

Cutting off the end joints (furthest from the body) of one wing with a sharp pair of scissors, knife or razor blade. The joint can be felt between finger and thumb by running along the wing from the tip, or in light-coloured ducklings it can be seen by holding the wing up in front of a strong light. The part of the wing which is severed is that which holds the flight feathers.

Cutting off the flight feathers after each moult and before flights are fully grown, but leaving a single outer flight for appearance's sake or *taping the flights together*. Some of the birds are almost sure to stray if these methods are used, since it is difficult to catch all birds at exactly the right time.

Cutting the extensor muscle. This is a job for a veterinary surgeon.

All these methods have the effect of throwing the bird off balance as it attempts to rise into the air, but pinioning does not appear to hurt or harm the bird in any way if it is done as soon as the young are fit to leave the nest.

INCUBATION

Incubating can be carried out artificially, adjusting incubator thermometer to suit the size of eggs set, and is useful when there is a shortage of good broody bantams or hens during the incubating period, provided that a good "Mother" is available to take over the care of youngsters hatched.

The more usual method is to use a broody hen or bantam, according to the size of the eggs to be set, and it is advisable for the breeder to run his own broodies rather than rely on neighbours' broodies, which may be temperamental. A good broody shuffles down on to your hand when you place it beneath her and when an egg is placed before her she tucks it under her with her beak.

A nest box should be placed on the ground for extra moisture, and a nest made for the broody by cutting out a piece of turf that will fit inside. This should be beaten to a shallow saucer-shape, dusted with insect powder and lined with soft hay. A few unwanted eggs should be put inside the nest and after giving the broody a good grain feed, she should be thoroughly dusted with insect powder under the wings and under the vent, and at dusk moved quietly to the nest box. When she seems to have been sitting well, say after twenty-four hours, she can be allowed out for a grain feed and a drink (previously placed just in front of her box), and the original eggs should be replaced by those to be incubated, a note having been made of the date upon which the eggs were set. She should be left sitting for twenty-four hours, then fed at exactly the same time every other day. If the nest box door is opened she will come out and help herself but it is important to free her at exactly the same time of day otherwise she will become restless and damage the eggs. If large goose eggs are being sat on and the hen cannot turn them herself she should be freed and the eggs turned daily.

Eggs should be as fresh as possible and those of wild breeds should be set as soon as possible after a clutch is complete. If storage conditions are similar, eggs from "made" breeds can be kept a little longer when set under a hen rather than in an incubator.

The best type of nest box is one that opens at the front rather than at the top because the broody is able to walk carefully in to cover the eggs. In the latter type she has to jump down amongst them and with small, delicate eggs there is always the danger of her crushing them.

Before the youngsters hatch a rearing coop should be ready. This should either have a portable run of its own, be set inside a portable rearing pen with wire-netting covered top, or should have a surround of wire netting to form a pen in a position where ducklings or goslings can be overlooked and protected from predators.

REARING THE YOUNG

After they hatch the mother will brood the youngsters until they are completely dry and fluffed up. They should then be placed in a chick box lined with hay, and the mother taken to the rearing coop where she is given a good feed of grain and water. While she is eating and settling down the

youngsters should be pinioned, and, after placing a first feed, as already described, in a container just outside the bars of the rearing coop, together with water in a jam-jar fount, the ducklings or goslings should be returned to the coop one at a time and simply placed in front of the broody. If she has been previously tried out she should take them readily enough. If possible, a spare broody should be kept on hand just in case a broody refuses to take back her offspring. If she does not take them the first time, she should be given a little longer to settle down and, failing all else, they should be placed under her after dark.

As the babies grow the size of the water container can be increased until, when feathers start to take the place of down, they can be allowed swimming water. Depending on the time of year, they may be allowed swimming water at a very much earlier stage if the weather is mild. Some experts even recommend swimming water at anything from a day onwards.

The parent duck or goose can of course be allowed to sit on her eggs and there are few more beautiful sights than the mother and ducklings (or goslings) on water. The mother objects to having her brood driven under cover at night and where very small ducklings are concerned they would get trampled on in doing so. They are therefore less protected than ducklings under a broody hen at night, and during the day the small varieties of duck are not so able to protect their offspring from predatory birds.

By-Products

THE only saleable by-products of the duck and goose industry in this country are feathers and manure.

FEATHERS

The amount of feathers on a duck or a goose will depend on its age, weight, and whether it is first or second feather, but as a guide five ducks will produce approximately 1 lb of feathers.

The analysis of chicken feathers is as follows, and it seems quite reasonable to assume that those of other poultry will be similar:

	<i>per cent</i>
Protein	73·15
Water	21·6
Fat	1·01
Ash	1·11

The protein contains an essential amino acid known as cystine, which is rich in sulphur. Duck feathers are much too valuable to be sold as manure, which is the fate of a large percentage of both chicken and turkey feathers. At plucking time the quills and stiffer tail feathers are thrown aside and kept separate, as it is the feathers from the body proper that are in such demand, particularly those from the breast, which are the finest and the softest. It has usually been said that feathers would pay the cost of plucking, but nowadays, even with high labour costs, some farmers still make a profit. Prices

seem to be continually rising, which shows a sustained and continued demand, and at present they are making from 6s. to 8s. per lb.

The use of feathers in the domestic and commercial world seems to be increasing. They have long been used for pillows and cushions, but it is now stated that they are valuable in making clothes for flying, or for any other work where insulation against intense cold is required.

During recent years, feathers have been used for decorations of many kinds, but mainly in the production of artificial flowers, and at least one firm in this country has made a special feature of this work. An appreciable percentage are duck and goose feathers, but particularly the latter. They lend themselves to bleaching, dyeing and painting, and the results, after careful and skilled handling, can be very attractive. The body feathers are used for the outer petals and the finer ones from under the wings for the centre portions. They can be bought as small buttonholes, as sprays for personal use and for the decoration of tables and shop windows. They are of such vivid colourings that many establishments find them not only equal in attraction to real flowers but in the long run a more economic buy. The wing feathers of the goose have been used for many years for making shuttle-cocks, and they have, of course, always been used in the feathering of arrows used for archery.

MANURE

Information available on the analysis of duck manure appears in Primrose McConnell's *Agricultural Notebook*, and it records the comparison between it and hen and goose manure. The figures are the mean of very large numbers of samples, and it is fairly safe to say that on an equal dry matter basis, duck manure is not as rich as that from hens as it contains roughly one-third less nitrogen.

	% N	% P ₂ O ₅	% K ₂ O	% Moisture	% O.M. (very approx.)
Ducks	0.75-1.0	1.2-1.5	0.5-0.7	50-60	25
Hens	1.3-1.7	1.5	0.7-1.0	50-60	25
Geese	0.5-0.6	0.5-0.75	0.75-1.0	70-75	15

The rather wet nature of duck manure makes it very difficult to handle in its pure state, but this only happens in battery brooding; in other instances it is mixed with litter of some kind.

The easiest and quickest removal of manure from a cafeteria battery soak-away is by the use of a "quick lift". This is really a pump that draws the droppings into a large container and many hundreds of gallons are literally sucked up in the matter of minutes. It is then taken on to the land and spread immediately. This means of collection and distribution can be used to the best advantage where a large acreage of land is available near at hand.

Most of the nitrogen in poultry manure is quick acting which makes it readily available to the plant, therefore it is inadvisable to store it for long and the sooner it is used the better. If storage is unavoidable, a cover of some kind should be placed over it to prevent it being washed away by rain.

To preserve the nitrogen content no lime should be added, as this will combine with the nitrogen and be given off as ammonia. It is estimated that chicken and turkey manure is equivalent to the quantity of food eaten. If

this also applies to ducks, on the assumption that 28 lb is eaten in nine weeks, a flock of 1,000 will deposit $1,000 \times 28$ lb, which equals approximately $12\frac{1}{2}$ tons of manure. This gives some idea of the task involved in the disposal of manure where large numbers are kept.

GOOSE LIVER

Although not often produced in this country, a continental by-product is the preparing of goose livers for making table delicacies.

The Egyptians apparently had the knowledge that the livers of geese could be increased in size and flavour by excessive feeding. This practice was also common in Greece and Rome. We understand that the Greeks esteemed the goose primarily for this enlarged liver, and that they were familiar with the cramming of the bird that brings this about. After removal the liver was soaked in honey and milk to further increase its size and flavour. In the Middle Ages the goose was familiar in England, and the fat goose liver was considered a delicacy, but it was apparently in the middle of the eighteenth century that a Strasbourg cook hit upon a new recipe which is used to this day. When preparing goose livers with truffles he discovered *Pâté de Foie Gras*.

Maintaining Health

A FLOCK of healthy, thriving birds will always show increased profits over one with high disease and mortality rates.

During recent years, the knowledge that effective drugs are available to combat disease has consoled many a duck producer, but under no circumstances should drugs be regarded as a substitute for good management; they are merely an adjunct to it.

In the first place, the breeding stock should be as free as possible from disease, and this applies in particular to the salmonella group of organisms which can be transmitted to the progeny. If hatching eggs or stock are bought in, it would be wise to inquire from the vendor if his stock is disease-free.

CLEANLINESS IS ESSENTIAL

Clean accommodation right from the beginning will give the young birds a good start in life. As already mentioned, the incubator room and all equipment in it should be thoroughly cleaned and disinfected between each hatch. Cleansing and disinfection must continue not only during incubation but through brooding, rearing and fattening; in other words, from the time the duck or goose is born until it is killed.

If it can be arranged that the land is used only once, danger from soil-borne infections will be reduced. Light, well-drained, sandy soil is the ideal, as it tends to harbour less disease and drains well. Heavy land is not suitable for large-scale duck farming as it gets too wet and soggy during the winter months. Excessive manure deposits are not conducive to good health, and over-stocking will create this problem. A constant supply of clean water is

essential, but this is not always easy to achieve, as ducks and geese tend to be very messy in both eating and drinking; however, regular cleaning of troughs will help. In the past, fowl cholera has occurred where birds have drunk contaminated water and as a precaution against this it is preferable to use piped water only. When ducklings and goslings are small, placing their drinkers on wire frames will help to keep the surrounding areas dry, (see Fig. 14) and if these and the hoppers are continually moved those bare patches that are still a regrettable feature of many farms will be avoided. Improper feeding will not only produce a poor bird, but it will also make it more prone to disease, inasmuch as its resistance will be lowered. A sick or ailing bird should immediately be removed from the pen, but if more than the odd one or two has to be taken out, then veterinary advice should be sought and a typical specimen sent to the laboratory* for a definite diagnosis. This is important as quick action might prevent further loss.

PREVENTING THE INTRODUCTION OF DISEASE

Any new stock of either sex purchased in the growing or adult stage should be segregated from the rest of the stock for two to three weeks as a precaution against the possible introduction of disease. Rats inhabit even the best-run farms, for where food is stored they inevitably make an appearance, and apart from killing baby ducklings or goslings, they may be carriers of certain diseases. It is known that salmonella infections may be spread in this way, so there should be continual effort to keep rats down. There are now many effective poisons available, most of which are harmless to anything but rats, so there is no need for this menace to be tolerated any longer.

Visitors and vehicles entering the farm should be regarded as a possible source of danger, particularly if there is any infectious disease in neighbouring farms, when feet and tyres should be disinfected as a routine precaution.

Delivery of food in paper bags has its advantages. The bags can be burned as soon as they are empty (bundles of sacks often serve as a cover in a food store for rats and mice) and there is no likelihood of possible infection being carried, apart from other obvious reasons. Because certain infections of turkeys and chickens may be transmitted by ducks and geese it is desirable to ensure that there is strict segregation of the different species.

DISINFECTION

As a routine measure all movable equipment should be taken outside and scraped, the remaining litter removed and the house thoroughly brushed down. Next, the floor must be scraped and the scrapings swept out after which everything should be scrubbed with warm water containing $\frac{1}{2}$ lb soda per 2-gal bucket. When the house has thoroughly dried out it should be sprayed with an approved disinfectant at the recommended strength. (An approved disinfectant means one that has been approved for use under the Diseases of Animals (Disinfection) Order, 1936, and which is sold in a container bearing a label showing that it has been approved.)

* Laboratory tests, post mortems, etc., are carried out for an appropriate charge at the Ministry's Veterinary Laboratories at New Haw, Weybridge, or Lasswade, Nr. Edinburgh, or at any of the Veterinary Investigation Centres throughout the country.

DISEASES†

Infectious diseases of ducks and geese are principally of importance in areas where large numbers are raised annually, particularly on farms where successive batches of ducklings are introduced at frequent intervals. Although severe infestations with external parasites, intestinal worms and blood parasites seldom occur in Britain, both ducks and geese are susceptible hosts for many parasites.

DUCK VIRUS HEPATITIS

Virus hepatitis is a highly infectious disease of young ducklings. It is only known to cause losses in young domestic and wild (Mallard) ducks. Chickens and turkeys on infected farms do not sicken and goslings are resistant. The disease is characterized by its sudden onset and rapid, violent course. Mortality of up to 90 per cent may occur within two days of the first deaths in ducklings under three weeks old. Resistance to the disease increases rapidly with increasing age so that losses in ducklings infected at four weeks of age seldom exceed five per cent. Death from virus hepatitis is rare in ducks over five weeks old.

Symptoms

The first deaths may occur within twenty-four hours of exposure. The disease spreads rapidly through the group. Practically all losses occur within 2–3 days of the first deaths. Often the biggest ducklings in the group are first to die without warning. Others may die within thirty minutes of the onset of symptoms. Affected ducklings become dull, cease eating and fail to keep up with the brood. Within a short time they fall on their sides with heads drawn back and paddle spasmodically with their feet. The bill is often congested and purple in colour. Sick ducklings continue to drink and may pass green watery excreta. Some affected ducklings make a rapid and complete recovery and are not noticeably lighter than non-affected ducklings.

Transmission

There is no evidence of transmission of the virus through the hatching egg. It is believed that infection normally occurs through the bird eating infective material. The virus appears in the excreta within a few hours of infection. The disease then spreads very rapidly through the affected group. The virus can live in infected litter, brooders, etc., for many weeks and in this way may cause disease in successive hatches.

It may be carried from infected to healthy groups in crates, vehicles, barrows or on the hands and clothes of attendants, etc., or transmitted from farm to farm by wild birds.

Confirmation of the diagnosis can be made by laboratory tests.

Prevention and Control

Since serious mortality occurs only during the first four weeks of life, methods of control have been concentrated on protection during this period.

The following methods have been recommended:

Isolation of newly-hatched ducklings from older infected groups. Due to the conditions on many duck farms effective isolation has proved difficult or impossible.

† Fuller details of diseases of Ducks and Geese are given in Bulletin No. 6 — *Diseases of Poultry*, which is now in preparation (September, 1960).

Farming Out. Since the virus does not appear to be transmitted from the egg, newly-hatched ducklings may be "farmed out" during the brooding period and brought on to the infected premises at four weeks, when they will have developed an age resistance. Care must be taken not to carry infection on crates, etc., back into the brooding premises when the ducklings are being moved.

De-population followed by Disinfection. This method can be successful provided that disinfection is thorough and effective. But since the virus may live under favourable conditions outside the duck for several months, the disease may recur after restocking.

Serum Therapy. Serum prepared from blood collected from survivors at the time of slaughter for table contains protective substances. This serum injected into all ducklings of a group in which losses are just commencing will reduce mortality, but unfortunately there are practical difficulties to the general application of this method.

Passive Protection. Ducklings hatched from eggs produced by survivors show considerable resistance to infection. This is due to the presence of protective substances which are passed from the duck through the hatching egg to the young duckling. Adult ducks which have been injected with a mild strain of hepatitis virus will produce these protective substances and pass them on to their progeny. Inoculation of breeding stock for the purpose of producing hepatitis-resistant ducklings has been carried out in Norfolk.

Active protection. If young ducklings are inoculated with this mild strain of virus it rapidly protects them from infection with virulent disease. This inoculation can be carried out on newly-hatched ducklings by stabbing the foot web with infected needles. This method has also been used in Norfolk.

NEWCASTLE DISEASE

(*Fowl Pest*)

Whilst ducks and geese may become infected by the virus of Newcastle disease and be able to pass it on to chickens and other birds, they seldom or never develop any symptoms themselves.

ANATIPESTIFER INFECTION

(*known also as Duck Septicaemia, New Duck Disease and Infectious Serositis*)

Anatipestifer infection is an infectious disease of ducklings caused by a bacterial organism. It was first described on Long Island, America, in 1932 where it has become the most important disease problem affecting ducks; in England it is known to occur in several counties. Growing ducklings of four to nine weeks old are affected but the disease may spread back to ducklings of brooder age or on to older groups. Adult ducks are resistant.

Incubation Period and Course

The incubation period varies from less than thirty-six hours to five days. Death may occur within a few hours of the onset of symptoms but in older groups it may follow an illness of six to seven days. Some ducks may survive but remain culls.

The disease may occur as a severe spreading condition affecting almost all ducklings in susceptible groups and causing mortality of up to 75 per cent. In some flocks the disease may be milder with lower mortality, in others it may occur as a sporadic condition affecting a few of the flock only.

Symptoms

Affected ducklings show many of the symptoms which are associated with Newcastle disease in chickens.

There is usually a watery discharge from the eyes and nostrils. Dullness with loss of appetite is accompanied by a green diarrhoea, the feathers around

the vent being stained green. Affected birds rapidly become weak and may be unable to stand; if stimulated, they cry out as if in pain and stagger away a few paces before flopping down or toppling over. There may be a continuous nervous movement of the head and neck or bobbing of the tail.

Ducks which survive a few days may develop permanent nervous symptoms and would die as the result of inability to get food and water. Those less severely affected lose condition, develop a staggering gait and the plumage becomes dirty and ragged. The hock joints may become swollen.

Diagnosis is based upon the history, symptoms and post-mortem findings, if possible confirmed by a bacteriological examination.

Prevention

It is not known exactly how the disease spreads; infection can take place through scratches, fissures and wounds of the skin and feet, and this may be the normal way of entry.

Where disease is present, steps should be taken to reduce injury to the feet and skin, since infection could enter after down pulling or foot injuries caused by hard stubble, prickly weeds (e.g., thistles, brambles, holly leaves) or by barbed wire.

On Long Island infection is heaviest among ducklings reared under crowded conditions during the cold damp weather of late winter and early spring. Losses decrease rapidly in warm weather.

Treatment

Ducks showing severe symptoms do not respond to treatment. Dosing with sulphonamide has reduced the death rate, and sulphamezathine given in the drinking water at a concentration of 0.2 per cent for two days followed three days later by a second two-day treatment is beneficial. Sulphaquinoxaline in the food at the rate of 1 lb per ton for one and a half days has reduced losses. Care must be taken in treating ducklings with sulphonamides since these drugs are relatively toxic for ducks and will check growth.

Aureomycin at the rate of 100 grams per ton of food given for a five-day period has resulted in improvement in the condition of ducks affected with anatispestifer infection, but the disease is liable to recur when treatment is withdrawn.

SALMONELLOSIS OR SALMONELLA INFECTION

(also known as paratyphoid)

The terms *Salmonellosis* or *Salmonella Infection* are used to describe the bacterial disease caused by any member of the group of salmonella except *S. pullorum*, the cause of pullorum disease, and *S. gallinarum* the cause of fowl typhoid. The disease usually occurs during the first few days of life, particularly when infection has occurred in the incubator. Salmonellosis is common in ducklings and is frequently referred to as Keel disease; goslings are also susceptible.

Symptoms

Symptoms are similar to those seen in *S. pullorum* disease in chicks. Ducklings suffer from loss of appetite, diarrhoea, tend to remain near the warmth of the brooder and often fall forwards on to their breasts and have difficulty in rising. Birds may be found dead without having shown symptoms of illness.

Bacteriological examination is essential for diagnosis and several carcasses should be sent to a veterinary laboratory for this purpose.

Transmission

Most types of salmonellae occurring in birds are also found in other domesticated animals and man. Rats and mice are often carriers of salmonellae and their droppings can contaminate the poultry food. Feeding incubator waste, infertile eggs, eggshell grit or swill containing poultry offal may introduce the infection. Second-hand incubators, brooders, etc., should always be thoroughly disinfected before use. Some chicks which survive an outbreak become "carriers" and the organisms may be excreted in the droppings for a period of many months, although some birds eliminate the infection much sooner. If there is faecal contamination of the shell of eggs laid by these "carriers", and the organisms remain alive, they can penetrate the shell during incubation and multiply within the egg. In the duck it is not uncommon for the ovary to be infected and thus direct transmission may occur and infected ducklings are produced.

Prevention and Control

Every effort should be made to obtain clean eggs by providing clean well-bedded nests. Eggs should be gathered as early as possible after the breeders finish laying and should be washed and fumigated (see p. 17).

Hatching eggs should never be soaked in cold water and wiped with a dirty cloth since this will help to spread the infection.

Furazolidone has been found to be effective in reducing mortality, but as some of the treated birds remain "carriers" of the infection they should not be retained for breeding stock. The presence of a group of survivors represents a focus of infection, and the disease may spread on the farm. Dead or culled ducklings and bedding should be burned and the house and equipment adequately cleaned and disinfected.

FOWL CHOLERA

Fowl Cholera is an infectious disease of chickens, ducks and geese caused by the organisms *Pasteurella aviseptica*.

The severe, rapidly fatal form of fowl cholera has not been observed in Britain for many years.

Symptoms

The disease usually affects flocks of over four weeks of age. Symptoms include loss of appetite, thirst, high body temperature and sudden death. Mucoïd white droppings followed by light green droppings are usually seen. Swollen hock joints due to localized infection are often seen in the late stage of an outbreak. Mortality may reach 50 per cent or even higher.

Positive diagnosis depends on bacteriological examination and carcasses from suspected outbreaks should be submitted to a laboratory for examination.

Prevention and Control

The last serious outbreak affecting ducks and geese in Britain was introduced by recently imported geese.

The advice given in the earlier part of this chapter regarding the isolation of newly purchased stock should always be followed.

If acute disease occurs, all sick birds should be killed and the carcasses disposed of by burning or efficient burial. All contact birds should be strictly isolated.

Feeding of antibiotic supplements at high level to all healthy birds which may have been exposed to infection would be a useful safeguard.

Vaccines are used in some countries but their use is not warranted in this country where the acute form of disease is so rare.

ASPERGILLOSIS

Aspergillosis is a disease which affects many species of wild and domesticated birds and is caused by the fungus *Aspergillus fumigatus*. The disease usually affects ducklings during the first two weeks of life.

Symptoms

Small ducklings may die suddenly without symptoms having been observed. Laboured breathing and other respiratory symptoms, are usually observed in older ducklings and mature ducks.

Prevention

There is no treatment of value. Mouldy straw appears to be the chief source of infection, so special care should be given to the selection of bedding for ducklings.

PARASITIC DISEASES

Domestic ducks in Britain are seldom infested with external parasites or worms.

GIZZARD WORM OF GESE

This is a small worm, fine as a piece of white cotton and from $\frac{1}{2}$ –1 in. in length, which buries its head in the inner lining of the gizzard. Old geese have considerable resistance to this worm, but young ones lose condition and may die from a heavy infestation.

Symptoms

Usually the first symptom noticed is a rather slow and staggering gait and the affected gosling will be very thin and weak.

Prevention and Treatment

As this worm is picked up from infested land, the birds should be moved to another field. Changing the birds' range as often as possible is the best way of preventing this trouble.

This worm does not often affect geese that have access to a large pond, stream or river. The use of small artificial ponds are not advised because the ground around them can soon become infested. Movable drinkers should always be provided and these should be shifted as often as possible since geese spend much of their time around them and, if their position is not often changed, the surrounding ground will get very foul.

Treatment, which is quite effective, consists of giving a capsule of carbon tetrachloride. For goslings up to 8 lb a 1 c.c. capsule should be given; over that weight 2 c.c. is required. Repeat the dose in about seven days time. Birds with this condition need good feeding, and a good layers' mash or boiled grain with a little milk or milk powder should be given, letting the birds eat all they can.

COCCIDIOSIS OF DUCKS

Coccidiosis is not a frequent cause of loss in duck rearing and outbreaks are usually sporadic, but there may be a high rate of mortality among untreated ducklings. The disease is caused by species of coccidia different from those found in chickens or turkeys. The parasites multiply in the cells lining the intestine, where heavy infestations cause inflammation and haemorrhage.

Symptoms

The first sign of coccidiosis is loss of appetite. This usually occurs on the fourth day after infection. Within a few hours weakness is apparent; there may be diarrhoea with blood in the droppings and affected ducks are disinclined to move.

Treatment

Serious losses will be prevented if, as soon as the first symptoms are observed, sodium sulphamezathine or sodium sulphaquinoxaline, are given in the drinking water. Full directions for dilution are given on the bottle.

RENAL COCCIDIOSIS OF GEESE

This type of coccidiosis is caused by the rapid multiplication of large numbers of parasites in the cells lining the tubules of the kidney. The disease is seen in intensively-reared goslings up to about three months old.

Symptoms

Affected geese have diarrhoea with whitish discoloration of the droppings. There is rapid loss of weight and inability to keep up with other birds in the flock.

Treatment

Sodium sulphamezathine or sodium sulphaquinoxaline given in the drinking water in accordance with manufacturer's instructions.

OTHER AILMENTS

SLIPPED WING

Both ducks and geese are affected by this condition, which may be hereditary or could be caused by wing damage when young, improper feeding, fright or bad management. The joints of the wing holding the flight feathers cannot be held in place, and the wing will either drop down or stand out at right angles to the body.

Treatment

There is no cure, but flight feathers could be cut back to about 1 in. from the joint, although the condition does not adversely affect the bird.

BOWED LEG DISORDER

Ducklings sometimes get bowed legs if they are reared on wire floors. It seems to be caused by a deficiency of niacin in the food, but can be prevented by adding either dried brewers' yeast, or synthetic niacin to the diet.

LAMENESS

Geese are very clumsy and often injure themselves; if caught or held by the legs they may go lame, but unless the leg is broken they will soon recover, although feeding may be necessary until they can walk again.

Prevention and Treatment

Geese should always be caught by the neck to avoid hurting their legs.

If young geese go lame, a level teaspoonful per bird of a good poultry mineral mixture mixed in their feed is usually effective.

Hard cornlike swellings may form on the underside of the feet if the birds are run on dry, hard or uneven ground. These usually clear if they are removed to a good pasture or softer, more even ground; if the condition becomes acute, the harder parts may be cut away with a knife and the area dressed with a neat antiseptic.

Appendix I

NUTRITION

The nutritive requirements of ducks are not, it would seem, fully known. The National Research Council of America's recommendations are for starting and growing ducks only, but no provision is made for fattening or breeding stock. Because no specific knowledge is available, the practical approach is to modify rations compiled for chickens and these seem to give good results.

All ducks irrespective of age, variety, whether they are intended for egg production or table will need:

- Carbohydrates
- Proteins
- Minerals
- Vitamins
- Trace elements
- Water

To get the best results they must be included in their correct proportions in a suitably prepared diet.

CARBOHYDRATES

These supply the heat and energy a bird requires. They are particularly important during the fattening stage because they are concerned with the laying down of body fat. There are many different types of carbohydrates, and they vary a great deal in character, but in poultry nutrition only the starches and sugars are important. If they supply the bulk of the starch it should constitute about 60 per cent of the ration. Cereals included in this group are, wheat oats, barley, maize, together with potatoes.

PROTEINS

Proteins make and repair tissue, and they are an essential part of the blood, feathers, eggs, etc. The requirements are greater in the developing duckling than in the fully matured bird. A starter (18 per cent protein), growers (16–17 per cent), fattening (14 per cent), and 15–16 per cent for breeding stock are thought to be satisfactory levels. Proteins can be divided into:

Animal Proteins

These include fish, meat, meat and bone, whale meal and liver meal, and also what can be termed by-products; dried milk, dried blood and liver meals. Dried milk and liver meal are usually included for their vitamin rather than their protein content, whilst blood meal, if fed at too high a level tends to make the ration unpalatable.

As the protein supplement is the most expensive part of the diet it should be kept as low as possible without affecting the benefits that should be derived from it. It should not, however, be lower than 5 per cent of the total diet.

Vegetable Proteins

These, as their name suggests, come from vegetable sources, such as peas, beans, ground-nut and soya bean meals. They are not so satisfactory as those from animal origin as they do not contain what is termed the “animal protein factor”, and they are also low in minerals.

A combination of the various proteins is advisable, as what one lacks another will supply, and this will ensure that all that is necessary will be present in the food.

MINERALS

The minerals associated with poultry nutrition are calcium, phosphorus, common salt and manganese.

Calcium and phosphorus are concerned with bone and eggshell formation. There is a certain amount in most feedingstuffs, but they are present in larger quantities in proteins of animal origin, and where this ingredient is kept at an economic level in the diet there may be a deficiency. This can be remedied by adding limestone and steamed bone flour.

The suggested ratio for chickens in the growing stage is 1:1 and for breeders 2:1, expressed in terms of lime to phosphoric acid ($\text{CaO}_2:\text{P}_2\text{O}_5$). Any change in this balance or a deficiency in either, will upset bone and eggshell formation.

Salt is necessary for growth and certain body functions, and it is recommended that $\frac{1}{2}$ per cent be included in all diets.

A ration deficient in manganese will produce shells of bad texture, and hatchability may also be affected. Cereals such as wheat and oats are rich in this mineral, and as they are always included in the ration there will be little likelihood of a deficiency occurring. However, if necessary manganese sulphate can be added.

VITAMINS

Lack of vitamins, particularly for intensively-kept stock, will bring about nutritional deficiency diseases. Vitamins are necessary for good health, for proper functioning of the body, for egg production, and hatchability. Many

of them are derived from natural sources such as yeast, milk, grass, fish oils, and as well as this most of them are now produced synthetically. Those intimately concerned with duck nutrition are Vitamins A, those of the B complex, D₃ and E.

TRACE ELEMENTS

Trace elements such as copper, iodine, iron, are found in most feedingstuffs and the quantities needed for normal metabolism are very small. Deficiencies seldom, if ever, occur.

WATER

If a constant supply of water is not available the ducks will not eat as much as they should and this will affect growth, the laying down of fat and egg production. It is therefore of paramount importance that water should be available at all times.

Appendix II

PREPARING OVEN-READY BIRDS

1. Remove the sinews by cutting around the legs about an inch below the hock. Break the bone where the cut was made, and if the feet are pulled away from the leg the sinews will come away with it. This is not always done with ducks as they are killed when they are very tender.
2. Cut between the two large wing bones and discard the end one.
3. Place the bird breast downwards with the head hanging over the edge of the table. Make a cut in the skin about 3-4 in. long down the centre of the neck, and with the left hand holding the neck sever this where it joins the shoulder. Leave a flap of skin sufficiently long to enable it to be turned back over the shoulders. Remove the crop and windpipe at this end.
4. Place the bird on the palm of the left hand, using the second finger of the right hand to loosen the lungs which are imbedded in the ribs near the backbone.
5. With the bird resting on its shoulders make an incision between the vent and the "parson's nose", this will expose the intestine which should be hooked with the first finger of the left hand. By inserting the knife between the intestine and the uncut skin the vent can be cut out.
6. Place the bird on its back with the tail towards you. First remove the fat around the abdomen then put the right hand inside the body and grasp the gizzard and give a slow and sustained pull which will result in the intestines coming out in one piece.
7. Keep the heart, gizzard, neck and liver and clean off surplus blood and fat. The gizzard of a duck is difficult to clean as the internal muscular

lining is tough, and it adheres tightly to the inner surface. If the gizzard is cut open and the contents removed it will be easier to do if it is immersed in boiling water for a few seconds. The gall bladder is very bitter and care should be taken not to break it when it is cut away from the liver.

8. The bird is now ready to truss. A 10-in. needle with about 16 in. of string will be required.
9. Pull the flap of skin on the neck back over the neck cavity. Push the legs forward and press them down on to the table whilst passing the needle through the top of the thigh, through the body, through the other thigh and across the back. Tie the two strings tightly.
10. Pass the needle through the skin just below the end of the breastbone, and then cross the string under the legs and tie firmly. Make an incision in the skin below this, and push the "parson's nose" through it. This will cover up the hole made for the removal of the intestines.

Appendix III

THE following trials were carried out by The British Oil and Cake Mills to determine at what age the ducks reached $5\frac{1}{2}$ lb.

It is interesting to note the variation in weight range between the different breeds and crosses.

B.O.C.M. POULTRY FEEDING TRIALS

STOKE MANDEVILLE 1954

Breeds

Ten teams consisting of 15 day-old ducklings and one team of 11 day-old ducklings. Of these, eight teams were Aylesbury, one was Pennine and two Aylesbury $\times$ Pekin.

Sexes

The ratio between the sexes were seventy-seven drakes to eighty-two ducks.

Feeding

Baby chick crumbs, and water *ad lib*. Flint grit was also given.

Management

The ducks were brooded under infra-red lamps for the first four weeks, the bedding was wood shavings. At four and a half weeks the ducklings were weighed at weekly intervals, individual weighings being done from the first week onwards.

Body Weights

At eight weeks the average weight of the 159 ducklings was 5 lb 13.89 oz. Breed averages were as follows:

<i>Breed</i>	<i>Drakes</i>		<i>Ducks</i>	
	<i>No.</i>	<i>Weight</i>	<i>No.</i>	<i>Weight</i>
		<i>lb oz</i>		<i>lb oz</i>
Aylesbury	52	6 2.08	62	6 1.71
Pennine	8	5 3.50	7	5 1.14
Aylesbury × Pekin	17	5 7.82	13	5 0.15
Average	77	5 14.30	82	5 13.51

The following is the result of all ducklings in the trial:

8 reached 5½ lb live weight at 6 weeks
 72 reached 5½ lb live weight at 7 weeks
 114 reached 5½ lb live weight at 8 weeks

Food Consumption:

	<i>lb</i>	<i>oz</i>
1st week		5.01
2nd week	1	2.93
3rd week	2	3.98
4th week	3	0.35
5th week	3	4.27
6th week	3	9.52
7th week	4	3.97
8th week	4	11.95
	22	9.98

Food Conversion

3.93 lb feed were required
 per 1 lb of liveweight gain
 to 8 weeks of age.

Appendix IV

PARTICULARS OF STARVED LIVE WEIGHT AND LOSSES ON PLUCKING AND TRUSSING DUCKLINGS*

	Group 1		Group 2		Group 3	
	Male	Female	Male	Female	Male	Female
Number	16	16	20	14	12	19
Starved live weight (lb)	6.9	6.4	7.2	6.6	7.2	6.7
Plucked weight as percentage of starved weight	93.3	92.8	91.3	90.3	89.3	90.6
Trussed weight as percentage of starved weight	60.6	60.6	65.3	66.5	65.6	66.5
Trussed weight as percentage of plucked weight	65.0	65.3	71.6	73.6	73.5	73.4
Average loss in ounces	On plucking		7.4	7.4	10.0	10.2
	On trussing		36.0	32.7	29.9	25.2
	On plucking and trussing		43.4	40.1	39.9	35.4
					39.6	35.8

NOTE. Trussed weight includes giblets. The average weight of giblets was 9.6 oz and was about 1½ oz more for males than for females.

The data for ducklings are based on group weighings and not on the weights of individual birds. They cover males and females in each of three groups. The ducklings in the first group were hatched on 26th April and were brooded in tier brooders and reared intensively on home-mixed feed. Those in the other two groups were hatched on 13th May, brooded in tier brooders and reared on home-mixed feed, one group on range and the other intensively on the floor.

The recordings are summarized in the above Table, which shows that, relative to their starved live weight, these ducklings had lower plucked weights and lower trussed weights than any other class of poultry at the Institute but not very different from chickens. The trussed weight as a percentage of the starved live weight was lower for the first group than for the remainder, but there does not seem to be any easily perceptible explanation in the data for the difference. The percentages are similar for the two sexes.

* Figures supplied by Shell Mex and B.P. Ltd. and the National Institute of Poultry Husbandry.

Appendix V

SUMMARY OF MAIN BREEDS OF DUCKS AND GEESE

DUCKS

<i>Breed</i>	<i>Colour of plumage</i>	<i>Approx. weight of adult</i>		<i>Egg-laying qualities and approx. annual egg production</i>	<i>Remarks</i>
		<i>Drake</i>	<i>Duck</i>		
Aylesbury	White	lb 10	lb 9	Moderate: 100	The largest and most excellent of table birds
Pekin	Creamy-white	9	8	Fairly good: 150	Yellow skin; more upright carriage than the Aylesbury
Muscovy	Black and White, Blue and White or White	10-14	7-8	Very poor: 40-60	The male is about twice as large as the female.
Rouen	Brown	10	9	Poor: 80	Resembles the Mallard closely in plumage.
Buff Orpington	Deep reddish-buff	7	6	Good: 180	Good laying breed
Khaki Campbell	Khaki	5-5½	4½-5	Excellent: 220	Excellent layers.
Indian Runner	White, Fawn, Fawn and White	3½-5	3-4½	Excellent: 230	Peculiar for their upright carriage; excellent layers.

GEESE

<i>Breed</i>	<i>Colour of plumage</i>	<i>Approx. weight of adult</i>		<i>Approx. number of eggs laid in a season</i>	<i>Remarks</i>
		<i>Gander</i>	<i>Goose</i>		
Embden	White	lb 30-34	lb 20-22	25-45	Large breed giving an excellent quality carcass.
Toulouse	Grey	28-30	20-22	25-60	Not so active as the Embden, but a better layer.
English	White or Grey, or Grey and White	17-20	14-16	30-80	Few strains are pure, having had Embden or Toulouse blood introduced.
Roman	White	10-15	8-13	40-65	Excellent quality flesh, although small.
Chinese	Grey or White	10-13	8-11	40-100	The skin is rather dark in colour; birds very noisy when strangers are about.

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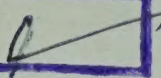
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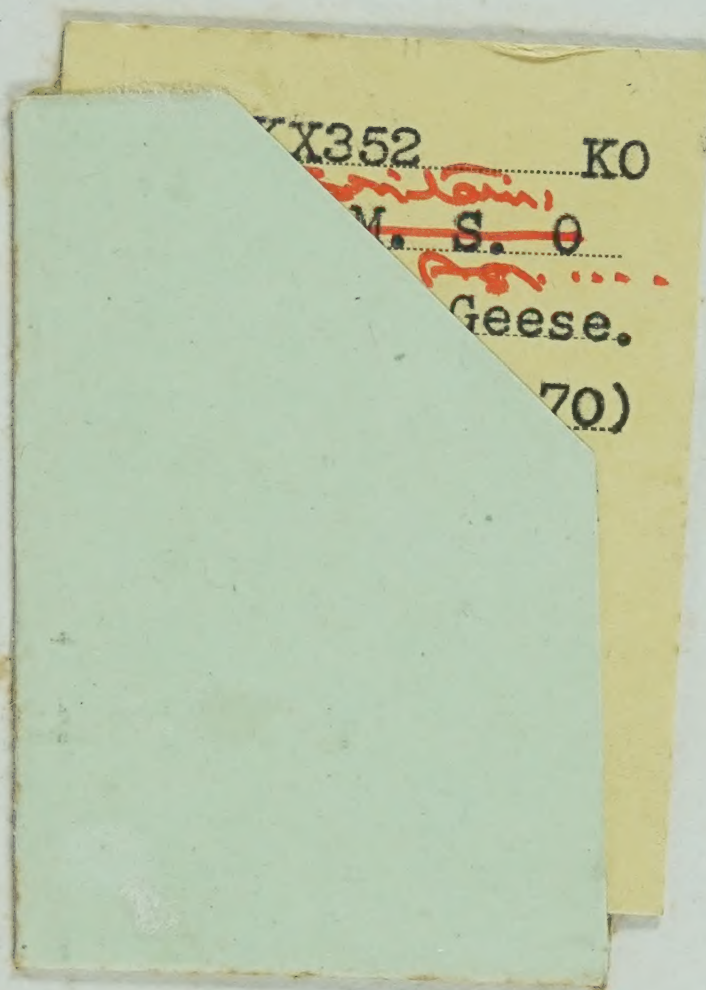


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